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(For Crops other than Herbage)

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Papers on Plant Genetics
Vol. I, No. 3.

Part I. British Empire

STATISTICS 519.2

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Agricultural field experiments.
Nature, 1930, **126**, p. 843.

Two letters, by " Student " and a critic, in which the former regards as very slight those errors arising from Beaven's use of one half of a drill for one variety and the other half for the variety to be compared.

The critic points out that if slight differences in spacing do not affect the yield, differences of depth, of sowing do. He advocates the modification of the method by taking strips (*a*) in " sandwiches " or (*b*) in pairs, and deciding at random which variety should come in the middle (*a*) or on the right hand side (*b*).

251. **Allan, F. E., and Wishart, J.** 519.2

A method of estimating the yield of a missing plot in field experimental work.
J. Agric. Sci., 1930, **20**, 399–406.

252. 519.2:633

Statistical methods in agronomic research.
Plant Breeders' Series Publ. No. 2, Canad. Seed. Grow. Assoc., Ottawa, Ont., 28 pp.

A practical guide to the planning of plot tests and the analysis of the results, dealing with the choice of land, the number of varieties used, size, shape and nature of the plots, number of replications, arrangement of varieties, use of check plots, border and competition effects, spacing, number of seasons and the calculation of the results.

ECONOMIC PLANTS 633

253. **Hudson, P. S.** 633:575

The present position of plant breeding.
Agric. Prog., 1930, **7**, 25–36.

A brief account of the aims and methods of the plant breeder. The most outstanding achievements of the breeder in various crops and the present lines of work are indicated. The crops are dealt with in turn starting with wheat, where emphasis is laid on the failure on the part of the industrial community to make full use of the improved varieties; work on other cereals is then discussed, followed by herbage crops, root crops, fruits and other horticultural plants, and finally a certain number of tropical crops which have received attention from the plant breeder.

254. **Ekbote, R. B.** 633:575(54)

The value of hybridization in the improvement of crops.
Agric. J. Ind., 1930, **25**, 398–407.

A review of the attainments of the plant breeder in general and in India in sugarcane, rice, wheat and cotton.

255. **Pridham, J. T., and Callaghan, A. R.** 633.11(94.4)

Varieties of wheat in New South Wales.
Agric. Gaz. N.S.W., 1930, **41**, 876–82; 1931, **42**, 13–19.

Descriptions of the chief wheat varieties grown with indications of their origin.

256. **Spafford, W. J.** **633.11:575(94.2)**
The importance of cross-bred wheats to South Australia. (Summary of an address delivered to the Rotary Club.)
J. S. Aust. Dept. Agric., 1930, **34**, 343–45.
It is shewn that almost all the most important wheat varieties have been originated by specialists in plant breeding.

257. **Newton, R., and Malloch, J. G.** **633.11:575.2:664.641.016**
Variation in the quality of wheat grown in replicate plots.
Sci. Agric., 1930, **10**, 669–77.
Variation in protein content and in texture of grain (vitreous-starchy) due to soil heterogeneity exceeded varietal differences on one set of plots. Significant comparative tests of baking quality can only be obtained from soil of great uniformity and working under very carefully controlled conditions. There was no correlation between protein content and yield.

258. **Gates, R. R.** **633.11:576.16**
The origin of bread wheats.
Nature, 1931, **127**, 325–27.
A very brief but rather full review of the findings of various authors regarding the relationships between *Triticum* and *Aegilops* and their various chromosome groups, of the position of *T. monococcum*, *T. persicum* ; wheat-rye hybrids and true-breeding amphidiploids ; the evidence for hybridization in the Japanese work on chromosome morphology, the evidence of chromosome pairing in *Triticum* and *Aegilops* species and the similar chromosome series occurring in *Avena* and *Agropyron*.

259. **Watkins, A. E.** **633.11:576.16**
The wheat species : a critique.
J. Genet., 1930, **23**, 173–263.
The author reviews the questions of the systematics and variation of the various wheat groups from the genetical standpoint. The parallel variation which exists in the *Emmer* and *vulgare* groups is emphasized and is well expressed by Vavilov's " Law of Homologous Series." Despite the fact that the two groups are clearly separated, it is almost impossible to find any single character which invariably distinguishes them ; and the separation appears to be brought about in the following ways : (1) the way in which characters are combined may be different ; (2) the extremes of variation may, in a few cases, be confined to different groups ; (3) an extreme variant may be common in one group and rare in the other.
The division of the three groups into sub-groups is discussed. On reviewing the characteristics of the members of the three groups it is clear that in passing from the *monococcum* to the *dicoccum* group a number of new characters and a greatly increased diversity appears. The sub-groups of this second group are not clearly marked off, rather they are linked up by intermediate types. The sub-groups of the third, *vulgare*, group, are closely allied and readily intercross.
The role of natural crossing and selection in evolution is discussed, followed by the origin of the genus, the three different distribution centres for the different chromosome groups and the probability of the origin of *T. vulgare* by doubling of the chromosome number in a hybrid between *Aegilops* and one of the emmer wheats.
The nuclear behaviour is described and figured for crosses of the 42 x 28 chromosome groups in which a regular number of bivalents (14) and univalents (7) appear ; also the 28 x 14 in which an irregular number (less than 7) of bivalents is usual, and of 42 x 14 with 0–5 bivalents. The cytology and significance of the various *Aegilops* x *Triticum* hybrids is discussed, the various chromosome combinations found in the pentaploid hybrids, Kihara's " Verminderungs " and " Vermehrungsgruppe," and the sterility phenomena involved. Under this latter head are included the various factors influencing the loss of the intermediate chromosome numbers, such as : grain germination and the effect of extra univalents on endosperm development ; failure to set grain, brought about by a failure of the egg cell to be fertilized by its own pollen ; the failure of the egg to function, the abortion of the embryo, if this exists ; elimination of zygotes, pollen

sterility, with elimination of grains with chromosome numbers below 21 ; a possible loss of univalents at reduction in the megaspore mother cell, in excess of that observed in microspore mother cells ; and an unequal segregation of univalents in this stage in the female.
The association of chromosome numbers and group characteristics in the pentaploid hybrids is discussed at some length. It is pointed out that in some cases characters associated with one or other group are transferred in groups in these crosses ; the fact that exchanges do rarely occur shews that these are linkage groups involving a number of genes. The general features agree with the view that the tetraploid and hexaploid series carry respectively two and three similar series of factors. The principles of inheritance in certain cases are described.
The speltoid mutants are discussed in relation to the hypothesis that they arise from irregular pairing of the three homologous chromosomes in the hexaploid wheats, with production of gametes of the type *ABB* and *ACC* in place of *ABC* and the subsequent formation of uni-, tri- and quadrivalents and types with 41, 42 and 43 chromosomes.
The agreement between the theory and the results of a number of authors, and at the same time certain discrepancies, are pointed out. Amongst these are the lack of crossing over in the linkage between bearded and speltoid, the elimination of pollen carrying the speltoid character, the defectiveness of normal segregates in certain strains, the non-occurrence of certain types postulated by the theory and the part mutations and factor mutations reported by Nilsson-Ehle.
The phenomenon of " shift " in crosses of tetraploid wheats is examined in the light of the explanation that autosyndesis occurs in connection with some of the chromosomes carrying the modifying factors. The hypothesis of an attachment or linkage between two chromosomes, brought forward to explain this and other phenomena, is shewn to be capable of other explanations. It is pointed out that the cumulative factor hypothesis, so feasible in the case of hexaploid wheats, is applicable with more difficulty to other non-polyploid plants.
In the concluding discussion on the origin of wheat certain difficulties are pointed out with reference to the hypothesis of chromosome doubling after crossing of diploid with some unknown species and of hexaploid with *Aegilops ovata* or *A. cylindrica*. The effect of recombination of characters followed by selection and of loss mutation on the origin of variation within the groups is referred to. It is suggested that the idea of several separate origins of the species conforms most nearly to the facts. Polyploidy affords an explanation of a great number of the phenomena and there is room for a large amount of further investigation into this and other points.

260. **Waterhouse, W. L.** **633.11–2.452–1.521.6:575.11**
633.13–2.452–1.521.6:575

Australian rust studies. III. Initial results of breeding for rust resistance.
Proc. Linn. Soc. N.S.W., 1930, **55**, 596–636.

The methods of hybridization and the degree of success are discussed in detail. Considerable success was secured by pollinating an ear severed from the plant and placed in water ; this is considered to be a valuable method for special cases.
Ears were removed from the plant at varying times after pollination and dried. Viable seeds giving normal seedlings were obtained 17 days after fertilization and seeds from ears collected as early as six days after fertilization gave a certain number of feeble seedlings.
Out of 1,932 pollinations made of wheat x barley, only five grains were obtained and these proved to be the result of self-pollination.
Only one hybrid was obtained from 2,020 crosses of wheat x rye. The plant was sterile and no backcross was successful.
A number of grains were obtained from Khapli emmer x Federation, but no plant reached maturity. Using Bunyip and Gullen as the *vulgare* parent, somewhat more success was obtained and ears produced ; they were sterile and no backcross progeny could be secured.
Khapli was therefore crossed with various *durums* in the hope of later combining the resulting resistant selections with *vulgare*. Resistance to form 46 of *Puccinia graminis tritici*, to which the *durum* parent is susceptible, proved in F_2 to be dependent on two factors. Resistance to the virulent form 34 appears to be inherited similarly.
Further crosses were made between Federation and three *durums* resistant to all forms but the group 45, 46 and 55. Resistance was dominant and F_2 ratios indicate the action of a single

factor. The F_2 also contained plants with considerable resistance to form 46, indicating the occurrence of transgressive segregation. Similar results were obtained from a cross between Marquis and Mindum.

The *vulgare* varieties Canberra and Thew shewed reciprocal reactions to the two groups of Australian forms of stem rust and were accordingly crossed.

F_1 tests shewed resistance to be dominant and F_2 and F_3 results shew that one factor governs resistance to each form. The Thew parent was also markedly resistant to Australian form 1 of *Puccinia triticina*, and this also proved to be dependent on one dominant factor, distinct and independent of the other two. This factorial interpretation was confirmed by the backcross with Canberra and F_3 to F_7 results of certain particularly promising families, both in greenhouse and field tests.

Form 34 later became prevalent and further crossing was made necessary to secure resistance also to this form, and Hope and Webster were employed. Certain of the Canberra x Thew hybrids have outyielded the standard variety Waratah.

The inheritance of certain characters, presence of " tip-beard," colour of chaff and of grain, was investigated. All were intermediate in F_1 and in F_2 monohybrid ratios occurred for tip-beards, chaff and grain colour ; an inhibiting factor causing low, grassy habit of growth was present. All these characters were independent of one another and of rust resistance.

These results were tested by an examination of F_1, F_2 and F_3 of crosses of each of the parents with Federation, a fully susceptible variety. The factorial analysis was confirmed, the inhibiting factor being shewn to be in Thew and it was also shewn that the factor in Thew for resistance to leaf rust was linked with a factor for resistance to one of the two forms of *Erysiphe graminis*.

Resistance to Puccinia triticina

Form 1 was also investigated in a cross of the varieties Riverina x Thew and Gluyas x Thew, shewing reciprocal reactions to forms 43 and 46 of *P. graminis tritici*. Monofactorial inheritance was again evident in F_2 and F_3.

A single dominant factor for resistance to *P. triticina* is also present in Japanese Bearded, as shewn in the Federation x Japanese Bearded cross, which served also for an examination of bearding, for which no satisfactory ratios were obtained in F_2, of grain colour, influenced by three factors, and for coleoptile colour, influenced by a single factor independent of rust resistance and grain colour.

A number of other crosses are described in summary form, in which it is shewn that resistance to form 34 is recessive, to forms 43 and 46 and *P. triticina* dominant. In Webster there are two cumulative factors each producing resistance to both forms 43 and 46, one recessive factor for resistance to form 34 and a further dominant factor for resistance to *P. triticina*. Webster also appears to be resistant to flag smut. Certain promising F_2 plants have appeared in which the resistance to form 34 is combined with desirable agronomic features.

The occurrence of grass clump plants which do not come into ear has been noted in a great number of different crosses. They have occurred in both 13 : 1 and 15 : 1 ratios.

In a number of oat crosses resistance to *P. graminis avenae* was dependent on a single dominant factor.

261. **Hanna, W. F., and Popp, W.** **633.13–2.451.2:576.16**
Relationship of the oat smuts.
Nature, 1930, **126**, 843–44.

Ustilago avenae and *U. levis* each contain + and — strains ; infection can be obtained by a monosporidial inoculation of a + strain of the one and a — strain of the other. This indicates that the two species are closely related.

262. **Morris, G. P., and Eff, M. A. K.** **633.16:575(62)**
A concise account of barley breeding, 1921/29.
Bull. Tech. Sci. Serv. Cairo, 1930, **102**, 11 pp.

The methods of pure line selection and testing are described in detail. The suitability of a number of these lines for malting is reported upon for the different years, some of them giving undoubted indications of quality. Hybridization work has just been started.

263. **633.51:575**

Empire Cotton Growing Corporation. Reports received from experiment stations, 1929/30.

In the preface it is stated that " the most conspicuous thing in the breeding work carried on at the various experiment stations is the success of U4 and its progeny—for already a number of improved strains, better suited than the original U4 to local conditions in the different places, are in process of development." U4 on account of its continued jassid resistance, combined with other qualities, was often the only variety to give satisfactory results. This is the keynote of all the reports, although a number of disadvantages of U4 are pointed out, which make further careful crossing and selection necessary.

In Fiji interest is being centred on certain Kidney-Sea Island backcrosses.

A pure line of Sea Island immune from leaf curl has been found in the Sudan.

264. **Koshal, R. S., and Turner, A. J.** **633.51:677.21:519.2**

Studies in the sampling of cotton for the determination of fibre-properties. III. The size and reliability of a satisfactory sample.

Tech. Bull. Ind. Centr. Cott. Comm., 1930, Ser. B, No. **10**, 39 pp.

The number of fibres which should be required to give a representative sample in estimating fibre length was 500, fibre width 300, convolutions, fibre strength or rigidity 500.

265. **Bose, R. D.** **633.522:577.88**

A study of sex in the Indian hemp.

Agric. J. Ind., 1930, **25**, 495–507.

It is concluded that the hemp used for the experiment has a natural tendency towards monoeciousness and that both males and females are potential hermaphrodites. Artificial control influences the expression of one or the other sex.

266. **Khanna, K. L., and Venkatraman, T. S.** **633.61:575:581.08**

Suggested method of studying sugarcanes for breeding work.

Agric. J. Ind., 1930, **25**, 306–12.

Comparative developmental studies were made of an " ennobled " Coimbatore cane, Co285 and two previously cultivated canes which it has replaced, Co205 and Katha, an indigenous cane.

It was found to develop sett roots more rapidly than Co205, these functioned for a longer period than in Katha and could exist with more success on sett roots alone than Co205. Shoot roots were formed earlier and at somewhat more frequent intervals than in Co205, less than in Katha ; the roots were as thick as Co205 and more profusely branched.

But germination was later than in the other two, the shoots erected themselves more rapidly. The growth rate of the Co canes in the later stages of development is greater than in Katha.

Such studies as these give a definite basis for selection in future breeding work.

267. **Craig, N.** **633.61:575:581.081**

The use of the refractometer in cane seedling selection work.

Int. Sug. J., 1931, **33**, 14–17.

It is concluded that the refractometer may with advantage be used in cane seedling work, since it affords a simple and rapid method of sampling of which the results are comparable in reliability with those given by the standard method in practice. It is advisable to take the mean of six borings from each stool to be investigated.

268. **Kostoff, D.** **633.71:575.242:576.356**

Chromosomal aberrants and gene mutations in *Nicotiana* obtained by grafting.

J. Genet., 1930, **22**, 399–418.

Shoots of a plant of *N. tabacum*, itself perfectly normal, when grafted on to *Datura Wrightii* shewed 25–30% of abortive pollen grains as a result of meiotic abnormalities.

Using *N. Langsdorfii* the flowers which developed near the union contained up to 70% abortive pollen, but those which developed further away were normal.

The F 1 progeny of the *N. tabacum* scion contained two abnormal plants having a high percentage of abortive pollen. One of these was larger and flowered earlier. It was partially fertile and shewed certain irregularities in chromosome number and behaviour. It seemed to have $2n=72$. The other plant was later than the rest and smaller ; 59 chromosomes were observed in the root tip and 35 to 40 at reduction. Chromosome behaviour was still more irregular but the plant was slightly self-fertile.

The F 1 progeny of the *N. Langsdorfii* contained 12 abnormal plants, 9 of which were dwarf and very late. Amongst these abnormal plants were individuals with 18 (normal), 19 (trisomic), 21 and 25 somatic chromosomes. All shewed irregularities at meiosis and some a high degree of sterility. The F 2 generations shewed great diversity of type and some apparent mutants.

Various physical and chemical agencies are known to cause irregularities of cell division and these abnormalities are considered to be occasioned in a similar way, as a result of incompatibility between the substances of the two species grafted.

269. **Haigh, J. C.** **633.74:581.162.5**
Cacao pollination.
Trop. Agriculture, 1931, **8**, 39.

Pollen was investigated from a tree which bears abundant pollen but has never set fruit. At the end of 24 hours only, 0·36% of the pollen had produced germ tubes as opposed to 72·4% in fertile trees. The pollen grains were larger than normal and had thin walls. The failure of self-fertilization is thus explained. Examination of the female parts of the flowers to explain the failure of cross-pollination is being undertaken.

270. **633.74:581.162.51**
Cacao pollination studies.
Bull. Misc. Inform. Kew, 1930, No. **10**, 501–2.

Germination tests were made in Ceylon on pollen from a sterile tree and compared with that from a normal tree. Only 0·36% of the pollen gave germ tubes as opposed to 72·4% in the good tree. The failure of self-fertilization is evidently one of the factors causing sterility.

271. **Hewison, H. K., and Ababio, N. K.** **633.74–1.547.5**
Flower and fruit production of *Theobroma cacao*.
Yearb. Dept. Agric. Gold Coast, 1929, Bull. **22**, Paper No. 11, 87–94.

Observations for ten trees were made on the number of flowers opening, shedding and setting fruit, the number of young fruits shrivelling, the number of fruits maturing and the increase in size of maturing fruits. Considerable differences in the performance of individual trees were observed, *e.g.* in quantity and in distribution of flowering over the year. The best tree yielded over seven times as much as the worst tree. About 99% of the flowers that opened were shed ; to what extent this is a result of lack of fertilization is being studied. No association of shedding with meteorological phenomena has been observed. The highest proportion of flowers setting fruits was 2·47%. Here again failure of fertilization may be the cause.

272. **Salmon, E. S.** **633.79:575(42)**
13th report on the trial of new varieties of hops, 1929.
J. Inst. Brew. Lond., 1930, **36**, 533–38.

The parentage of a large number of new varieties is given. The yields, aroma and preservative qualities also taken into account and certain of the new hybrids are very promising ; estimates were made also of the weight (number of bushels to the cwt.) ; two of the seedlings exceeded the richest foreign hops by 0·83 and 0·13% respectively in resin content.

273. **Salmon, E. S., et al** **633.79:575(42)**
The breeding of new varieties of hops with special reference to the requirements of the brewer. (Discussion.)
J. Inst. Brew. Lond., 1930, **36**, 578–91.

The author describes his breeding experiments at Wye College and the production of hybrids richer in resins than the rich American parents and of hybrids combining the mould resistance of the Golden Hop with the strong growth of the green leaved types. Some of the hybrids were resistant to Downy Mildew and others to mosaic ; many combined high yield with other desirable features, including aroma.

274. **Crane, M. B., and Lawrence, W. J. C.** **634.1/2:581.162.5:576.356.5**
Sterility and incompatibility in diploid and polyploid fruits.
J. Genet., 1931, **24**, 97–107.

The result of a number of years' investigations on cherries has shewn that self-incompatibility is the rule, cross-incompatibility is common and always reciprocally expressed. Nine intra-sterile inter-fertile groups have been established among cultivated varieties.

The variety *Big de Schrecken* when crossed with certain varieties gives a progeny consisting of two groups which are intra-sterile but inter-fertile. This indicates that each of these parents has one factor in common and a preliminary factorial constitution is assigned to them. By making a number of combinations of various varieties in this way a factorial analysis was made of 38 varieties ; at least 6 incompatibility factors had to be assumed to explain the results.

Plum varieties are divided into self-compatible, self-incompatible and partially self-compatible groups. Here different degrees of compatibility in reciprocal crosses frequently occur.

The results are very much more complicated than in the cherries and it is thought that this is caused by the polyploid nature of the plums, giving the possibility of 3 incompatibility factors in each gamete, with a resulting increase of the number of gametic types. This condition lowers the possibility of entirely similar individuals meeting and so reduces the number of completely incompatible combinations.

In a combination of the type $S_1S_1S_1\ S_2S_2S_2 \times S_1S_1\ S_2S_2\ S_3S_3$, when the latter is male those gametes which carry S_3 are expected to function, whereas with the former as the male no gamete carries factors different from the female and the cross is therefore incompatible. This principle is given as an explanation of the differing results from reciprocal crosses.

It is thought that a fertility factor exists, allelomorphic to the series of incompatibility factors.

In apples triploid x diploid were as productive as diploid x diploid, although the seeds and vigour of the progeny were markedly less. The good results obtained from the triploids is ascribed to the greater variety of gametic composition resulting from the complex chromosome constitution.

275. **Hooper, C. H.** **634.23:581.162.5**
The study of pollination in relation to cherry orchards.
J. S.E. Agric. Coll. Wye, 1930, **27**, 202–04.

Fruitfulness varies from absolute self-sterility in the sweet cherries to full self-fruitfulness in Morello. Many varieties are also inter-sterile so that choice of suitable pollinating varieties is very important.

A table is given which shews which varieties will successfully fruit together.

276. **634.25:581.162.3**
Some observations on the pollination of peaches (*Prunus persica* Benth. and Hook.)
Agric. J. Ind., 1930, **25**, 492–94.

A brief description of the process of pollination of the peach, based on two years' observations. Although conditions are such that self-pollination occurs, setting by selfing is very rare.

277. **Latter, J.** **634.972.2:575.242**
Schizocotyly and genetic variation in Acer.
New Phytol., 1931, **30**, 66–68.

Certain seedlings were observed with three cotyledons, the later leaves of some of them being also bipartite. It is thought to be a genetic variation.

278. **Strong, W. J.** **635.63:575.11**
Breeding experiments with the cucumber (*Cucumis sativus L.*).
Sci. Agric., 1931, **11**, 333–46.

The inheritance of a number of characters was examined in the F1 of various crosses, two of which were carried on to the F2. The results are tabulated.

Shape of fruit was dependent on both size and shape factors. In a cross of a variety with a long, slender fruit and narrow, tapering neck with a variety with short, thick fruit and round, shorter neck, types emerged in F2 with long necks and short fruits and others with short necks and long fruits. "Tipped" fruits seemed to be partially dominant to rounded fruits, with modifiers influencing the expression of the "tipped" character.

Linkage was observed between the characters "mottled," "dull," "warty," "thick," and "tough" associated with the American White Spine type. These characters may be governed by a single factor or closely linked. Such linkages greatly enhance the difficulties of breeding desired types.

Seven characters shewed complete dominance: regular length of internode dominant to irregular, grooved and ridged stem dominant to smooth and round, mottling of fruit dominant to non-mottling, dullness of fruit dominant to glossiness, wartiness of fruit dominant to non-warty, thick tough skin dominant to thin tender, black spines dominant to white.

Nine characters lacked dominance and of these three appeared to be inherited on a one-factor basis, giving approximately a 1 : 2 : 1 ratio:—

Colour of fruit.
Colour of spines.
Number of spines.

The other six were on a multiple factor basis:—

Size of leaves.	Length of fruit stalks.
Colour of leaves.	Length of fruits.
Length of internodes.	Size of spines.

Non-clustering fruiting habit was dominant or partially dominant to clustering.

279. **MacArthur, J. W.** **635.64:575.116.1**
Linkage studies with the tomato III.
Trans. Roy. Soc. Can., 1931, **18**, 1–19.

Fifteen characters, with their symbols, established in previous works of the author are enumerated and their F2 and back-cross ratios and linkage relations tabulated.

Six linkage groups are established, as follows:—

I. Tall-dwarf, smooth-peach fruit skin, short-elongate fruit and simple-compound inflorescence.
II. Red-yellow fruit.
III. Long-brachytic internodes, orange-clear fruit skin.
IV. Cut-potato leaf, normal-"self-pruning" habit.
V. Purple-green stem, non leafy-leafy inflorescence, smooth-fasciated fruit.
VI. Green-yellow foliage, smooth-hairy stem, dark base-uniform unripe fruit colour.

Part II. Foreign

STATISTICS 519.2

280. **Zaleski, M. E.** **519.2**
Expériences multiannuelles et multilocales. (Multiannual and multilocal experiments.)
Bull. Assoc. Intern. Sélect Pl. Grande Culture, 1930, **3**, 204–16.

The author subjects to a severe examination all the methods which are currently applied to the criticism of collective tests. He recalls that in Chap. X of his *Methodology* he has proposed the carrying out of a series of comparative tests based on several criteria ; that which the author considers as essential in the " general concordance " of the results of each test ground with the average results of all the tests ; this concordance to be measured by Bravias's coefficient of correlation.

As a second criterion, the author takes, according to the cases, the variation coefficients or indices of the results obtained for all the varieties in each testing ground.

Then are taken the deviations of the relative yields of each variety in each testing ground, deviations calculated according to the respective general averages which give him fairly good ideas as to the value to be attributed to the different tests.

Consequently, the method used by the author for criticising the results of collective tests does not rely on any single character, but on the complexes of many characters.

GENETICS 575

281. **Sax, K.** **575.116.1**
Chromosome structure and the mechanism of crossing over.
J. Arnold Arb., 1930, **11**, 193–220.

A new theory of crossing over is attempted. An examination of a large number of chromosomes in different species shews that the chromatids are closely associated and are coiled ; the number of chiasmas or nodes is reduced between diplotene and metaphase. In this process of the reduction of the chiasmas as many as three or four crossovers are possible in some chromosomes. Any agency which will affect chiasma formation should therefore affect crossing over.

282. **Yasuda, S.** **575.12:581.08**
A method of obtaining self-fertilized seeds in the self-incompatible plants (Prelim. Rep.).
Proc. Crop. Sci. Soc. Japan, 1930, **2**, 122–26.

Secretions which inhibit pollen in certain self-incompatible Petunias were found to appear about the time of opening of the flower buds. If self-fertilization was done before this a certain number of successful pollinations were effected.

283. **Laibach, F.** **575.12:581.08**
Kreuzungsschwierigkeiten bei Pflanzen und die Möglichkeiten ihrer Behebung. (Difficulties in crossing plants and the possibility of removing them.)
Ber. deuts. Bot. Ges., 1930, **68**, 58–77.

A frequent difficulty in making species crosses is the difference in time of flowering of the two species. This can usually be adjusted by suitable cultural conditions. A number of agencies are known which break the vegetative period of plants, amongst the most important of which is artificial illumination. The different length of time which species retain the pollen viability is also important ; this varies from a few hours to several months in certain cases under carefully regulated conditions. Various factors affecting the duration of pollen viability and pollen germination are mentioned.

The part played by the failure of the pollen tube to penetrate to the egg cell is discussed, with the various factors influencing this, such as length of style, temperature, age of style, questions of compatibility, etc., and various other factors causing failure of fertilization.

Piróvano's experiments on the influence of a magnetic field on the success of a cross are mentioned and the desirability of confirmation pointed out.

If fertilization is effected the success of the cross depends on the development of the zygote. For the development of fruit it is sometimes necessary that more than one embryo be formed. A certain amount of self pollen in such cases would ensure that this minimum number of embryos was formed and thus ensure the development of any hybrid embryo which might also be formed. Incompatibility between maternal and hybrid tissues, even in such simple matters as size of seed, play a large part in the successful development of the zygote. By studying the relationships between the mother plant and seeds the hybrid embryo can sometimes be fostered. The author has even succeeded in removing the hybrid embryos from the fruit and culturing them artificially. The plants produced in this way often give perfectly normal seeds on selfing, although the plants themselves may be delicate.
The incompatibility between hybrid embryo and maternal tissue has sometimes a physiological basis. However, the author considers that with increasing study of the physiological relations, many of these, as well as other difficulties in effecting a difficult cross, will be overcome.

284. **Kappert, H.** **575.125**
575.14

Heterosis und Inzuchtfragen. (Heterosis and inbreeding questions.)
Der Züchter, 1930, **2**, 358–68.

The phenomenon of true heterosis is distinguished from the yield increase brought about by the union of cumulative factors in that its effect is almost confined to the F 1 generation, later generations falling off again in yield up to a certain minimum—the " inbreeding minimum."
In the same way the phenomenon of heterosis differs from the effect of complementary factors where there is no continuous falling off in later generations. However, if a larger number of complementary factors is considered then the falling off in F 2 occurs on account of the greater rarity of favourable combinations. By describing a number of theoretical and certain actual cases of hybrids involving varying numbers of cumulative factors, the author makes it clear that there is no difference between the two phenomena.
It is pointed out that with 10 such factors for yield, only 5·63% of the individuals in F 2 would have the most favourable combination and if these are overlooked then there is bound to be a falling off in later generations. If the favourable combinations are selected then the increased yield of the F 1 should be retained in later generations.
Somewhat similar results are obtained on the assumption that the phenomenon of heterosis is a result of the heterozygous nature of the hybrids and that the nearer they approach to the homozygous state the lower is the yield. A number of heterozygous plants are known, however, which are not more vigorous than the homozygotes.
It has also been suggested that heterosis only occurs when one parent contains certain growth inhibiting factors in the homozygous recessive state and the other parent possesses the corresponding dominants, there being a close linkage of the recessives of certain factor pairs with the dominants of others. This gives the possibility, in rare cases resulting from crossing over, of obtaining a homozygous vigorous segregate. Individuals with suddenly increased yield, which is maintained in later generations, have been observed in inbred lines and can be explained on this basis.
It is important from a practical point of view to know which of these hypotheses is most nearly true, since the first and third both suggest the possibility of selecting homozygous segregates with yields as high as or higher than the F 1, whereas on the basis of the second one this is an impossibility.

285. **Kostoff, D.** **575.148:575.74:575.243**

The degeneration of pure lines.
Sofia, B.A. Kozhukharov, 1930, pp. 16.

A number of agencies which affect the floral organs shortly before or during meiosis may bring about nuclear irregularities with the formation of mutants. Among these may be mentioned many common fungicides, plant parasites, grafting, sudden changes of temperature. The continuous production of mutants in this way is regarded as a potent cause of degeneration in pure lines.

286. **Stubbe, H.** **575.243**
Untersuchungen über die experimentelle Auslösung von Mutationen bei *Antirrhinum majus* II Samen-und Keimlingsbehandlung mit Röntgenstrahlen und Chemikalien. (Researches on the experimental liberation of mutations in *Antirrhinum majus* II. The treatment of seeds and seedlings with Roentgen rays and chemicals.)
Z. indukt. Abstamm.—u. Vererb.Lehre, 1930, **56**, 202–32.

287. **Buchholz, J. T., and Blakeslee, A. F.** **575.243:537.531**
Radium experiments with *Datura* I. The identification and transmission of lethals of pollen-tube growths in F1's from radium-treated parents.
J. Hered., 1930, **21**, 119–29.
Pollen tubes, as they passed down the stigma, were treated with radium emanation and the progeny examined. Recessive genes were evidently produced causing the following abnormalities : failure of half the pollen grains to germinate, early bursting of the pollen grains, retarded growth of half the pollen grains.

288. **Blakeslee, A. F.** **575.243:539.16**
F1's from radium-treated pollen.
Anat. Rec., 1930, **47**, 383.
Nearly half the F1's from treated pollen were abnormal in appearance. A number of both normal and abnormal plants had high proportions of aborted pollen and various chromosome irregularities. Individuals with chromosome circles were mostly normal with good pollen, those with chains abnormal with bad pollen.

289. **Haberlandt, G.** **575.257**
Das Wesen der *Crataegomespili*. (The nature of *Crataegomespili*.)
SitzBer. Preuss. Akad. Wiss., 1930, **20**, 23 pp.
The periclinal chimaera nature of this plant is finally demonstrated and established.

290. **Rudloff, C. F.** **575.257**
Propfbastarde. (Graft hybrids.)
Der Züchter, 1931, **3**, 15–28.
One of the few questions which remains to be solved regarding " graft hybrids " is whether true hybrids can be formed in this way. A hybrid has been defined as the product of the union of two genotypically different gametes. A true " graft hybrid " would therefore be a heterozygous individual arising from the union of the hereditary characters of the two individuals grafted.
A number of classical cases of graft hybrids are mentioned and described. Most of these have been shewn to be chimaeras. There is no evidence forthcoming to shew that the genetical constitution of one can be influenced by the other.
The most valuable feature of chimaeras is thought to be the possibility they afford of introducing disease resistance without otherwise altering the characters of a plant.

291. **Kostoff, D.** **575.73:633;575.243**
Chromosomaberrationen und Genmutationen als Ursache des Saatgutsabbaues. (Chromosome aberrations and gene mutations as the cause of seed degeneration.)
Ann. Agric. Fakult. Sofia Univ., 1929/30, **8**, 317–23.
Various factors contribute to bringing about chromosome aberrations and gene mutations; amongst these are plant, animal and bacterial pests, extremes of temperature, of nutritional elements and of light, if they occur at the time of the reduction division. These may often be the cause of changes in a crop with resulting phenomena of degeneration.

292. **Babcock, E. B.** **576.16**
Cyto-genetics and the species-concept.
Amer. Nat., 1931, **65**, 5–18.
The species concept in general is discussed, followed by gene mutation, chromosome fragmentation and transformation and polyploidy in their relation to the origin of variations. The conception of the genom (specific chromosome complex) establishes the concept of the species on a much clearer basis from all its points of view.

293. **Kendall, J.** **576.356.5:581.088.1**
Histological and cytological studies of stems of plants injected with certain chemicals. (A contribution to the gall problem.)
Dissert. Sofia Univ., 1930.
A number of polyploid shoots arose after injection of various substances. This is put forward as a valuable means of experimentally producing polyploid plants of economic value.

294. **Schaffner, J. H.** **577.84:633.15:581.035**
Sex reversal and the experimental production of neutral tassels in *Zea mays*.
Bot. Gaz., 1930, **90**, 279–98.
A method was evolved whereby the sexual condition of the tassels could be regulated to almost any extent, producing entirely neutral vestigial tassels if desired. The sex is influenced by a number of factors, one of which is length of illumination, a reduced illumination tending towards femaleness ; thus at a particular point a vestigial inflorescence will be produced whilst beyond this point female organs tend to form. Such effects can also be induced by adjusting the time of sowing.
Exactly similar results were obtained in highly inbred lines and the effect is evidently due to the environmental influences rather than the genetic constitution of the plants.

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295. **Schratz, E.** **581.082**
Einfluss künstlicher Beleuchtung auf höhere Pflanzen. (The influence of artificial lighting on higher plants.)
Der Züchter, 1931, **3**, 45–57.
A full discussion of the subject in which it is shewn that artificial light can quite successfully replace normal daylight for the growth of plants.
Later experiments are cited to shew that each plant has an optimal amount of lighting and that by increasing the normal daylight by an appropriate period of artificial illumination a better growth can be induced.
Root development in particular seems to be much improved with increased periods of illumination. More than anything is the time of flowering influenced by illumination ; this is of great value in breeding work since not only does it give the possibility of producing more than one generation a year, but also enables plants to be brought to flower at the same time which normally bloom at widely different periods and cannot therefore be used for crossing.

296. **Buchholz, J. T.** **581.162.3:578.6**
The dissection staining and mounting of styles in the study of pollen-tube distribution.
Stain Techn., 1931, **6**, 13–24.
Full details of the method are given.

297. **Chandler, C.** **581.162.3:578.6**
A method for staining pollen-tubes within the pistil.
Stain Techn., 1931, **6**, 25–26.
A new simplified method is described.

298. **Nebel, B. R.** **581.162.3:578.6**
Lacmoid-Martius-yellow for staining pollen-tubes in the style.
Stain. Techn., 1931, **6**, 27–29.
A rapid and simple method suitable for pomaceous plants, cherries, plums and grapes.

299. **Buchholz, J. T., and Blakeslee, A. F.** **581.331.23:575:539.16**
Pollen-tube growth and seed production after radium treatment.
Anat. Rec., 1930, **47**, 382.
Certain genes were shewn to give inherited effects recognizable during pollen-tube growth, but having no visible effects on heterozygous sporophytes. Many of these are transmitted through the female gametophyte generation in 1 : 1 ratios and eliminated in the male gametophyte.

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300. **Bonvicini, M.** **633:575(45)**
Le champ de sélection de l'Institut de Culture Végétale à Bologne, pendant l'année 1929–30. (The field trials of the Institute of Cereal Culture of Bologna, during the year 1929/30.)
Bull. Assoc. Internat. Sélect. Plantes Grande Culture, 1930, **3**, 67–80.
The author reviews selective research work executed at the Bologna Institute, on numerous varieties of wheat, barley, oats and rye. He sets forth the method used to ascertain the best varieties ; acclimatization, cultivation by separate ears, multiplications.
A number of hybrids shew useful combinations of desirable characters.

301. **Gescher, von** **633:575(47)**
New principles in plant breeding.
Int. Rev. Sci. Pract. Agric., 1931, **22**, 1–4.
An account of the new methods evolved by the Institute of Applied Botany in Russia, involving the discovery of the centres of distribution of the various crop plants, the law of homologous variation and its significance for the breeder, the significance of the cytological findings and of chromosome doubling in the elucidation of old phenomena and the production of new types.

302. **Appel, O.** **633–2–1.521.6**
Pflanzenpathologie und Pflanzenzüchtung. (Plant pathology and plant breeding.)
Der Züchter, 1930, **2**, 309–13.
A discussion of the importance of breeding in combating disease, and the various questions which are involved, such as physiologic forms of the organisms, artificial infection and low temperature. The author emphasizes the necessity for close co-operation between the breeder and the pathologist.

303. **Mumford, E. P.** **633–2:7–1.521.6**
Studies in certain factors affecting the resistance of plants to insect pests.
Science, 1931, **73**, 49–50.
The characteristics which tend to give resistance or immunity are discussed.

304. **Heinisch, O.** **633.1–1.547.1**
Der Einfluss der Kornlage auf die Resultate des Keimversuchs. (The influence of the position of the grain on the result of a germination experiment.)
Fortschr. Landw., 1931, **6**, 1–8.
In germination tests it was found that grains placed with the furrow uppermost germinated before those with the furrow below.

305. **Heuser, W.** **633.1–1.557**
633.14:575.125

Die Ertragsanalyse von Getreideversuchen. (Yield analysis of cereal experiments.).

Bull. Assoc. Intern. Sélect. Pl. Grande Culture, 1930, **3**, 161–67.

By yield analysis the author means the dividing up of the output of an area into its constituent elements. In cereals the yield per unit of surface is the product of the spacing by the yield per ear which in turn is the product of number of grains by weight of grain.

The relative importance of the various elements which enter into the composition of the yield was the object of analysis. The " compactness " is not only a function of tillering, but also of " earing " ; the number of ears formed from a number of tillers is shewn to be a varietal characteristic and there are types which give a large number of ears of low individual production and other types giving the reverse of this.

The structure of the yield was examined in an F1 rye hybrid shewing heterosis, which was compared with the parents. In two cases the " compactness " in the hybrid was intermediate between the parents, in other two somewhat higher. The thousand corn weight was invariably intermediate. The yield differences were chiefly brought about by differences in number of grains per ear, which was invariably higher in the hybrid.

Comparisons were made on similar lines between normal plants and plants grown in reduced sunlight. Here the thousand corn weight was most depressed in the corn of Panzer, other wheats suffered less.

Such analyses of yield are considered of the highest importance to the breeder in making his selections and an international scheme has been started for examining the structure of the yield in different countries over a number of years. Holland, Sweden, Hungary, Germany and France are already represented and investigators in other countries are invited to participate.

306. **Johnston, C. O.** **633.1–2.452:575.242**

An aberrant physiologic form of *Puccinia triticina* Eriks.

Phytopathology, 1930, **20**, 609–20.

Found on a highly resistant strain of Mediterranean wheat, Texas 3015–63. A type differing from all known forms and suspected to have arisen by mutation.

307. **Levine, M. N., and Cotter, R. U.** **633.1–2.452:576.16:575.12**

A synthetic production of *Puccinia graminis hordei* F and J.

Phytopathology (Abs.), 1931, **21**, 107.

A hybrid form of rust obtained by crossing *Puccinia graminis secalis* x *Puccinia graminis tritici* attacks certain varieties of rye and wheat which the parental forms are unable to attack and also attacks barley.

308. **Sapĕhin, L. A.** **633.11:575.11:576.356**

Ueber die faktorielle Natur der Unterschiede im Verlaufe der Reduktionsteilung. (On the factorial nature of differences in the course of the reduction division.)

Ber. deuts. Bot. Ges., 1930, **48**, 443–57.

A. A. Sapĕhin observed a number of irregularities of the reduction division in a pure line of *vulgare* wheat, comparable with those induced by chemical and physical agencies. F1 hybrids with other *vulgare* forms were normal. The F2 of such a cross was divided into individuals with 0–2 per cent. abnormality coefficients and those with 3–64 per cent. and a clear Mendelian segregation was observed, the genes for normal division being dominant. The irregularities in the original line were apparently occasioned by three recessive genes.

In the F2 of a cross of *Triticum vulgare* and *durum* one plant was observed which had a number of gigantic pollen grains in an average proportion of 10 to 12 per cent. These were found to be

diploid pollen grains resulting from a failure of the chromosomes to separate at the reduction division. The plant had 16 bivalent chromosomes and 4 univalent (16II + 4I).
In the F_3, those individuals with this same chromosome constitution, 16II + 4I, again shewed the same tendency to form diploid pollen grains, other individuals did not.
In another F_3 family there was no connection between the chromosome number and the formation of diploid pollen grains and their formation was clearly governed by the segregation of certain genes. The author mentions other cases in which the reduction division is influenced by particular pairs of genes and considers that his results have an important bearing on such phenomena as the chromosome doubling in *Aegilotrichum* and such forms and on the understanding of the relationships existing between the gene and its medium, " milieu."

309. **Nieves, R.** **633.11:575.11 –181.13**
Investigaciones sobre la herencia de los caracteres en el trigo. (Investigations on the inheritance of characters in wheat.)
Bol. Minist. Agric. B. Aires, 1930, **29**, 177–86.
In a cross of two normal patents, Guatraché 10 x –27 (Barletta x Florence) seven families segregated into normals and dwarfs in the approximate ratio of 13 : 3 in F_2, the F_1 being normal. A statistical examination of the results shewed that they conformed to the 13 : 3 ratio required on the assumption of two factor pairs, *Ee* dominant for dwarfness and *Nn* dominant for normal habit, and at the same time inhibitor of *E*. It appears that Barletta has the constitution *eenn* and Florence *EENN*. This is being examined by back-crossing.

310. **Rosenquist, C. E.** **633.11:575.125**
Hybrid vigor in wheat (*Triticum vulgare*).
J. Amer. Soc. Agron., 1931, **23**, 81–105.
Comparisons were made over a three-year period on 1,590 hybrid and 2,692 parent plants belonging to 26 different wheat crosses.
There seemed to be a slight dominance of earliness, for only in 11·5% of cases were the F_1 plants as late as the late parent. In most cases earliness in the hybrids is associated with yields above the parental average, but in the hybrids of Nebraska 28 dominance of lateness seems to have been associated with increase of yield.
In tillering 42·3% of the hybrids surpassed the better parent and only 11·5% were poorer than the inferior parent. High tillering went side by side with high plant weight.
In the number of tillers bearing ears 53·8% of the crosses were better than the higher parent. There was a close relationship also between this character and the yield per plant.
Height is not regarded as a very satisfactory character on which to judge vigour. Plant weight was chosen as the most suitable, the yield of grain agreeing rather closely with this. The date of anthesis shews a correlation with these characters.
In general, 12 out of 26 crosses were consistently earlier and better than the parental average, 4 better but later ; of these 8 were significant. Five crosses were more vigorous and earlier than the better and earlier parent, 4 were more vigorous but later or intermediate. Of these 2 were significant.
Out of 156 differences studied, 68 were significant ; 62 (40%) of these were above the parental average and 12 above the higher parent.
For plant height 7 crosses were significantly higher than the higher plant, for plant weight 3 ; spike weight and grain weight came next in order.
It is pointed out that in a not inconsiderable number of cases the F_1 was inferior to the parents. Four crosses were consistently lower in all characters but plant height. It is assumed that certain partially dominant factors depressing growth must exist.
Some of the hybrids continued to shew increased vigour under conditions of closer spacing whilst others were less consistent and shewed decreased yields (some below the poorer parent) under conditions of close spacing.
The amount of hybrid vigour displayed by these crosses is of no commercial value unless it can be perpetuated in homozygous lines.

311. **Rosenquist, C. E.** **633.11:575.125**
The immediate effect of foreign pollen upon the kernel weight of wheat (*Triticum vulgare*).
J. Amer. Soc. Agron., 1931, **23**, 43–63.
Selfed seed was compared with " incrossed " seed by closing the florets of one side of the ear with paper clips to enforce self-fertilization and emasculating the other side to ensure pollination from an ear of the same pure line placed beside it. The " incrossed " grains were slightly, but significantly, lighter in weight than the selfed. This difference is thought to be due to the frequently delayed fertilization of the emasculated flowers.
Using similar methods, but producing selfed and crossed seed on different plants, 7 crosses shewed an increased weight of grain and 21 a decrease, the average difference being 10% in favour of the selfed kernels. These decreases were displayed consistently over a period of three years ; there was no indication of hybrid vigour in any of the crosses, only 18 cases being observed of an increase in crossed over selfed seeds and only 2 of these were significant.
Out of 22 cases in which the difference was significant, only 2 of these were increases.

312. **Kuhn, K.** **633.11:575.125:575 –18**
Die äussere Wertigkeit quantitativer Eigenschaften in F1 und deren phänotypische Beeinflussung durch Heterosis. (The value of quantitative characters in F1 and their phenotypic alteration by heterosis.)
Z. Züchtung, 1930, A. **15**, 345–56.
The F1 hybrids of various pure lines of wheat were compared with the parents. The F1 shewed an increased vigour of growth and earlier formation of leaves and tillers, the average tillering of the hybrid being 13·14% higher than the average of the parents. This, however, is ascribed to the dominance of high tillering. The majority were intermediate in the time of ear emergence, but 5 plants (15·61%) were earlier than the earlier of the 2 parents.
The culm length was intermediate both in crosses of two unequal and of two more or less equal parents, with a tendency to dominance of long culms. Short ear seemed to be dominant to long and lax ears to dense. The yield was in 97% of the cases higher in the hybrid than that of the higher yielding parent. This was expressed in higher yield of grain, higher " plant yield " and higher ear yield.
The author concludes that the phenomenon of heterosis makes it difficult or impossible to decide upon the dominance or recessiveness of many of these quantitative characters.

313. **Tschermak, E.** **633.11:575.127**
633.14:575.127
Ueber die praktische Verwertbarkeit der Weizen-Roggenbastarde. (On the practical value of wheat-rye hybrids.)
Deuts. landw. Pr., 1931, **58**, 29–30.
There is an ever-increasing tendency to replace rye by wheat in Germany and the author suggests that some of his wheat-rye hybrids may be more successfully cultivated on the rye lands than wheat, having amongst other qualities the advantage of early ripening.
The wheat-rye hybrids are described ; they are lacking in viable pollen and hence sterile. The progeny of backcrosses contains fertile individuals of the wheat type, individuals of the F1 type, partially or quite sterile and rye types which are almost sterile ; even after two backcrosses to rye no fertile intermediate or rye type has been observed.
The fertile wheat types also proved to have 42 chromosomes and to give the wheat reaction to brown rust. Some of the segregates gave baking tests better than the standard and good yields. Some of them are awnless, winter-hardy and very early and it is hoped will be eminently suitable for cultivation in the dry rye belt.

314. **Blaringhem, L.** **633.11:575.127**
Sur un hybride autofertile d'*Aegilops* et de Blé (*Aegilops ovata* L. x *Triticum dicoccum* Schub. *var. Ajar* Percival). [On a self-fertile hybrid of *Aegilops* and wheat (*Aegilops ovata* L. x *Triticum dicoccum* Schub. *var. Ajar* Percival.)]
C.R. Acad. Sci. Paris, 1930, **191**, 362–66.

The wheat which Percival calls *T. dicoccum* Schübeler *var. Abyssinicum*, the author regards as having more affinity with the *durums* than with the *vulgares* and spelts. It differs markedly in appearance from the typical *dicoccums*. With *A. ovata* 9 good hybrid grains were obtained. The hybrid plants were very early and mostly sterile on artificial pollination of the basal florets of the spikelets with *Abyssinicum* pollen. However, some of the florets of the third order set grain and appeared to be self-fertile.
The author considers that the later formed flowers of such intergeneric hybrids tend to increase in fertility.

315. **Plotnikowa, T. W.** **633.11:575.127:576.356**
633.14:575.127:576.356

Zytologische Untersuchung von Bastarden zwischen 28-chromosomigem Weizen und Roggen. (Cytological investigations on hybrids between 28-chromosome wheat and rye.)
Planta, 1930, **12**, 167–83.

The success of wheat-rye crosses depends very much on the particular races used and it has recently been possible to secure 100% success and even to succeed in rye-wheat crosses. The fertility of the F1 varies very largely too.
From three wheat species crossed with rye pollen in 1927, 24 grains were obtained, of which only 7 germinated; three reached maturity.
Root tip examinations shewed two plants with 21 chromosomes, corresponding to the F1 number for the hybrid, 14 wheat + 7 rye; the third plant had 28, being the somatic number for the *emmer* parent and is regarded as a natural hybrid.
More crosses were made the following year. The hybrids were not so vigorous as the parents, matured earlier than the wheat parent, the anthers were almost empty and never burst. The plants were pollinated with pollen from both parents but were quite sterile.
The length of ear and number of spikelets was greater than either parent and also the awns in one of the hybrids. A full description of the hybrids is given.
The meiosis is similar to that in hybrids of *T. vulgare* and rye. The course of division is described. At anaphase two groups of chromosomes are evident, joined by fragmented chromosomes. Univalent chromosomes sometimes divide; more than 25 elements are seldom present in anaphase I_1 although in certain cases as many as 40 were observed. True bivalents were not found.
The second maturation division is also irregular, though less than the first. The pollen grains mostly have dwarf nuclei, sometimes two or three.

316. **Berg, H.** **633.11:575.127:576.356**

Zytologische Verhältnisse der Weizen-Roggenbastarde. (Cytological relationships of wheat-rye hybrids.)
Deuts. landw. Pr., 1931, **58**, p. 30.

The chromosome-behaviour of wheat-rye hybrids and the backcrosses is briefly described, shewing how the various products of segregation described by Tschermak are occasioned.
The forms of most value will be those which have the full complement of rye chromosomes with certain wheat chromosomes in addition; such forms naturally occur extremely seldom.
The possibility of producing constant forms with doubled chromosome number analogous with *Aegilotricum* and *Triticum turgidovillosum* is also of great practical importance.

317. **Khlebnikova, N. A.** **633.11:575.127:576.356.5:581.45**

(Comparative anatomical investigations of the vegetative organs and kernels of rye-wheat polyploids.)*
J. Agric. Sci., S.E. of U.S.S.R., 1930, **8**, 305–21.

Two polyploids with 56 chromosomes from the F_4 of a rye-wheat cross were compared in a number of morphological characters of the leaf and stem, with the original parental forms and the F1. They differ sharply from one another, but each possesses a certain number of characters from both parents. One of the polyploids approximates closely to the wheat type, the other to the rye type. The F1 plants were strictly intermediate.

* A full translation of this paper is on file at the Bureau.

318. **Vakar, B. A.** **633.11:575.127.2:576.356**
Cytological investigation of hybrids between *Triticum persicum* Vav. and other wheat species.
Sib. Inst. Agric., Lab. Genet., 1930.
Similar phenomena are recorded to those observed by other authors in the *p.m.c.* formation of the pentaploid wheat hybrids, except that an irregular arrangement of the univalents at anaphase I and longitudinal division of the univalents were observed. Thus, instead of regularly 21 chromosomes in the daughter-cells, as in the case of Kihara, numbers varying from 14 to 21, usually 18, occurred.
Irregularities occurred also in the tetraploid hybrid *T. persicum* x *dicoccum*.

319. **Wakakuwa, S.** **633.11:575.127.2:581.08**
Bestäubungs- und Keimungsversuche in reziproken *Triticum*-Kreuzungen. (Pollination and germination experiments in reciprocal *Triticum*-crosses.)
Jap. J. Genet., 1930, **6**, 93–100.
Crosses between different wheat species with similar and different chromosome number were carried out. More grains were obtained when the parent with the higher chromosome number was used as male, the germination was better with this as the female.
Pollination of species with the same chromosome number shewed no reciprocal differences in number of grains set or germination power.

320. **Tschermak, E.** **633.11:575.129**
Neue Beobachtungen am fertilen Artbastard *Triticum turgidovillosum*. (New observations on the fertile species hybrid *Triticum turgidovillosum*.)
Ber. deuts. bot. Ges., 1930, **48**, 400–7.
The hybrid between *T. turgidum* and *T. villosum* is largely intermediate between the two parents. Hybrids of *T. villosum* with *T. durum*, *T. Spelta* and *Aegilops ventricosa* were sterile. The fertile hybrid *T. turgidovillosum* was found to be constant over six generations, comprising over a thousand individuals, and it may truly be regarded as a new species.
Vegetative cells of F_2 plants displayed both chromosome garnitures in diploid number and at reduction division in haploid number. This is a result of the fact that in F_1 hybrids in the production of gametes no pairing of the chromosomes occurred, with doubling of their number and failure of any possibility of gene interchange. The fertility is a result of the splitting of these single chromosomes which brings about the failure of reduction and results in a condition of true diploidy. This phenomenon the author terms "chromosome addition." This assumption is amply supported by the cytology of the hybrids; *T. turgidum* has 14/28 chromosomes, *T. villosum* 7/14, whilst the zygotes of the F_2 and later generations have 42 (14 + 28) and the gametes 21 (7 + 14). The course of the reduction division is perfectly normal, except that the *T. villosum* pairs are distinguished from the rest by their slightly different form, a difference which was already obvious in the parents.
A number of crosses of *T. turgidum* with other species are being investigated.

321. **Lathouwers, V.** **633.11:575.242**
La variabilité (non fluctuante) dans une lignée de *Triticum vulgare*. Apparition de variantes speltoides stériles. (The variability (non-fluctuating) in a line of *Triticum vulgare*. The appearance of sterile speltoid variants.)
Bull. Soc. Bot. Belg., 1930, 2nd Ser. **13**, 49–54.
In the wheat Institut de Gembloux, characterized by white ear, beardless with short tip awns of 1 cm. length, rather lax, with red grain, the following variants were found:

1. Red eared, beardless, smooth chaffed, greatly varying in density, apparently resulting from accidental admixture or perhaps natural crossing.
2. White eared, beardless, rough chaffed, rather lax. No such type was in cultivation in the district and it appears that natural crossing with Benefactor has occurred.
3. White, smooth, bearded, rather dense ; evidently impurities.
4. Three plants, the first of which was of the speltoid type, but shedding the grain with comparative ease, ear lax. The progeny of this plant contained certain bearded plants with extremely narrow ears, very brittle and almost completely sterile ; other plants were almost typical *T. vulgare* types.

The second of the three speltoids had glumes closely adhering to the grain ; it segregated similarly to the first. The third was similar but rather denser ; its genetic behaviour was similar.

322. **Åkerman, Å.** **633.11:575.42:664.641.016**

Det svenska vetets kvalitet och försök till dess förbättrande genom förädling. (The quality of Swedish wheat and experiments to improve it by hybridization.)
Sverig. Utsädesfören. Tidskr., 1930, **40**, 57–85.

The quality and baking capacity of home and foreign wheats were investigated.
Chemical investigations by accurate methods were undertaken on protein, gluten content, etc., of the kernel and the flour from which the weight of the dough and the bread was determined, besides comparing loaf volume, height of the loaf, porosity, etc. The wheats could then be grouped according to their baking capacity. In the first group are the best Russian, Roumanian, Hungarian and American " quality " wheats of the hard winter type. In the second Svea wheat II and Swedish Sammet wheats, in the third Thule II and Sonnen wheat III, in the fourth Kronen wheat, Stahl, Standard, Svea I and Jarl wheats, the last group is formed by the Square-head wheats.
A similar grouping was arranged for the spring wheats which give a loaf of 20% greater volume. I. Marquis, II Red Fife and Svalöfs Kolben, III. Extra Kolben I and II, Rubin and Dutch wheats, IV. Aurora and Diamant, V. Spring wheat of the weak type, *ex* Rote Schlanstedter and its crosses.
On the basis of these researches hybridization experiments have been begun with the object of combining the good baking quality of the two first groups with the high yield and stronger straw of the south Swedish varieties. Some new breeding strains have already been obtained whose characters are shown in a table.

323. **Hollingshead, L.** **633.11:576.356**

The occurrence of unpaired chromosomes in hybrids between varieties of *Triticum vulgare*.
Anat. Rec., 1930, **47**, 380.

In F_1 hybrids of Garnet and Marquillo 43·2% of the plants shewed univalents. A few of the parental plants shewed similar irregularities. Crosses of these two parents each with Red Fife showed a smaller amount of these irregularities than the Garnet x Marquillo hybrids.

324. **Luzzatto, G.** **633.11:581.132.3**

La cleistogamia e l'antesi in alcune razze elette di frumento. (Cleistogamy and anthesis in certain select lines of wheat.)
Nuov. Giorn. Bot. Ital., 1930, **37**, 687–746.

A full account of the relations of flowering and pollination in the different wheat varieties examined, with observations on the proportion of cleistogamous flowers. None of the varieties was without cleistogamy, none entirely cleistogamous. The author thinks it possible that by selecting for this character in a variety like Carlotta Strampelli, which is very prone to cross-fertilization and consequent contamination, it would be possible to establish a race with this tendency much reduced.

325. **Bonvicini, M.** **633.11:581.46**
Spiga ramificata in un grano tenero. (A branched ear in a soft wheat.)
Ital. Agric., 1930, **3**, 146–50.
A branched ear has been obtained in *Triticum vulgare* at the Institute at Bologna. This is of interest from the point of view of plant genetics and agricultural botany, because such ears had previously been known only in *Triticum turgidum* L. and *T. dicoccum* Schübl. The method of obtaining the branched ear is described in detail.

326. **Huber, J. A.** **633.11–1.547**
Wachstumsrhythmus bei Winterweizen. (Growth curves in winter wheat.)
Pflanzenbau, 1930, n. **3**, 1–5.
The growth curves of various wheat species, varieties and hybrids differing in time of maturity are compared. The ear emerges from the sheath more quickly in " xeromorphic " types than in the common " mesomorphic " forms. By the aid of such studies it is hoped to be able to decide for what type of conditions a wheat is suitable.

327. **Lemaire, and Blondy** **633.11–1.557**
Des particularités du tallage et de la montaison chez les blés à grand rendement. (The characteristics of tillering and growth habit in high-yielding wheats.)
Bull. Assoc. Intern. Sélect. Pl. Grande Culture, 1930, **3**, 170–73.
The authors classify varieties of wheat with strong and medium tillers in five categories according to the length of the circumference which limits the circle occupied by the ears of a plant, or in other words the area of " spread."
In selecting for yield, it is necessary to choose those individuals which have a large number of tillers and at the same time bear them in compact clusters so as to have as many ears as possible to the square metre. This ensures that the plant has strong roots and sufficient air and sun to prevent the bases of the shoots becoming diseased.

328. **Crépin, C., Alabouvette, L., and Chevalier, R.**
633.11–2.111–1.521.6:575
633.13–2.111–1.521.6:575
La résistance au froid chez le blé et l'avoine. (The resistance to cold of wheat and oats.)
Bull. Assoc. Intern. Sélect. Pl. Grande Culture, 1930, **3**, 137–47.
The authors examine the mode of action of cold and shew that the consequences of cold on wheat may lead to the death of the plants, by two different processes.
If the cold is not too intense and if the plant has at least three leaves, mortification sets in at the axis in the region of the seed ; the rotting of this region leads to the division of the seedling into two parts : the one, the roots with the seed, which remains in the ground, the other, the aerial part, borne by the axis or rhizome emerging from the seed.
The terminal shoot is killed directly by intense cold.
The dangerous temperatures vary, on the one hand, with the different varieties, and on the other, with the temperature of the weeks which have preceded the falls of temperature.
The authors have shown that, contrary to current opinion, the attributes of resistance to cold and productivity are not antagonistic. The F_2 generations of 7 crosses contained 11% of individuals as resistant as the resistant parent and the F_3 14·5%. On testing under more intense cold only 1 or 2% proved to be equal to the parent. The author proposes, by back-crossing continuously with the resistant parent, to build up a type combining resistance and the other qualities desired. That a number of factors is involved is shewn by the production of a resistant individual from two susceptible parents.
Winter oats are all characterized by a great susceptibility to lodging, but resist cold greater than –15° C. Spring oats, certain varieties of which offer great resistance to lodging, are killed by cold in the vicinity of –10° C.
With a cross between winter oats and spring oats, the authors have succeeded, thanks to several winters that have played the part of " weeding out," to obtain a type that resists both lodging and cold.

329. **Reichert, I.** **633.11–2.451.3:576.16**
The susceptibility of American wheat varieties resistant to *Tilletia tritici*.
Phytopathology, 1930, **20**, 973–80.
Six strains of the fungus were shewn to exist, with indications of the existence of others. A certain loss of virulence was indicated when cultures were grown in other countries.

330. **Bressman, E. N.** **633.11–2.451.3:576.16:631.521.6**
Physiologic forms of bunt of wheat and varietal resistance.
Phytopathology (Abs.), 1931, **21**, p. 108.
At least six forms of *Tilletia levis* and four of *Tilletia tritici* exist. Practically all the varieties of wheat classed as resistant are attacked by one or other of these forms. Rye was susceptible to some and *T. secalis* is designated as a form of *T. tritici*. Hosar, a selection by the author from Woolman's hybrid Hussar x Hohenheimer " behaart " is resistant to all forms.

331. **Flor, H. H.** **633.11–2.451.3:577.8**
Indications of heterothallism in *Tilletia tritici*.
Phytopathology (Abst.), 1931, **21**, p. 107.
Inoculations with monosporidial cultures of *Tilletia tritici* produced no infection, but mixed monosporidial cultures usually gave infection.

332. **Nieves, R.** **633.11–2.451.3–1.521.6:575**
Ensayos comparativos de resistencia a la *Tilletia laevis* (Kuhn) con trigos Argentinos e importados comunes y de pedigree. (Comparative trials of the resistance to *Tilletia laevis* Kuhn of common and pedigree wheats, Argentine and imported.)
Bol. Minist. Agric. B. Aires, 1930, **29**, 297–317.
Trials have been made of 154 varieties belonging to five different sub-species, according to Vavilov. Certain of the Argentine hybrids were highly resistant and two North American ones immune ; most of these belonged to the sub-species *erythrospermum* coming from some region where smut epidemics are very serious.
From a cross of *T. vulgare v. ferrugineum* x *T. persicum v. fuliginosum*, nine plants were obtained which were attacked by all three rusts, although *T. persicum* was immune, illustrating the recessive nature of this immunity. These F1 plants were 94–95% self-sterile. It is pointed out that those wheats which are immune or highly resistant to loose smut are also resistant to covered smut and vice versa. Certain exceptions to this rule are indicated, with a number of factors which might bring about this discrepancy.

333. **Nieves, R.** **633.11–2.451.3–1.521.6:575**
Contribución al conocimiento de la " caries del trigo " (*Tilletia spp.*). Sus caracteres biológicos—su comportamiento genético—bases para la creación de variedades resistentes. (Contribution to the knowledge of the bunt of wheat (*Tilletia spp.*). Its biological characters—its genetic behaviour—bases for the development of resistant varieties.)
Bol. Minist. Agric. B. Aires, 1930, **29**, 97–112.
After a discussion on the nature of resistance the author points out that physiologic forms appear to exist in *Tilletia* and refers to work of his own as well as other authors in which it is proved that resistance is recessive in crosses of certain varieties, other crosses displaying intermediate segregation with no member equal to the resistant (Kanred) parent, whilst in still other cases transgressive inheritance occurred. The results of certain authors with *Ustilago avenae* are cited.

334. **Appel, O.** **633.11–2.452 P.glumarum:576.16**
Beiträge zur Kenntnis der physiologischen Formen des Weizengelbrostes. (Notes on the knowledge of the physiologic forms of yellow rust of wheat.)
Angew. Bot., 1930, **12**, 463–70.
An account of the recent work on *P. glumarum* at the Biologischen Reichsanstalt at Dahlem. Five physiologic forms have been clearly established, each associated with different regions of Germany and the neighbouring countries.
Resistance is greatly reduced at low temperatures and varieties have been tested to discover one which retained its resistance under such conditions and which will be resistant to all forms of the parasite.

335. **Gassner, G., and Straib, W.** **633.11–2.452 P.glumarum:576.16**
Ueber das Auftreten einer neuen Gelbrostform auf Weizen. (On the appearance of a new form of yellow rust on wheat.)
Der Züchter, 1930, **2**, 313–17.
The unexpected infection in 1927 of certain resistant wheats is reported; certain varieties normally susceptible proved somewhat resistant. Single spore cultures were made of the material and the existence of more than one form of *P. glumarum tritici* demonstrated.

336. **Newton, M., Johnson, T., and Brown, A. M.** **633.11–2.452:576.16:575.12**
Hybridization between *Puccinia graminis tritici* and *Puccinia graminis secalis*.
Phytopathology (Abst.), 1931, **21**, 106–07.
Crosses of forms 30 and 95 of *Puccinia graminis tritici* with *Puccinia graminis secalis* have produced four hybrid rusts, three of which were hitherto unknown. The hybrids resemble each other rather closely in pathogenic characters, being much less virulent on wheat and rye than other known forms of the respective series.
Hybridization between these two then seems to present no danger in originating new virulent forms.

337. **Hanna, W. F.** **633.11–2.452:581.162.4**
Nuclear association in the aecium of *Puccinia graminis*.
Phytopathology (Abst.), 1931, **21**, p. 107.
About 48 hours after nectar containing pycniospores is applied to a pycnium of opposite sex binucleate cells appear in the hyphal wefts near the lower surface of the leaf, quickly followed by multinucleate cells.

338. **Isenbeck, K.** **633.11–2.452–1.521.6:575.11**
Vererbungsstudien an einigen Weizenkreuzungen in bezug auf die Widerstandsfähigkeit gegenüber *Puccinia glumarum tritici* und *Puccinia triticina*. (Inheritance studies with certain wheat crosses in relation to resistance to *Puccinia glumarum tritici* and *Puccinia triticina*.)
Z. Züchtung, 1931, A. **16**, 82–104.
The reaction in greenhouse tests with various single physiologic forms and in field tests was determined for certain old and also a number of new hybrids between varieties of *Triticum vulgare*.
Puccinia glumarum.
The cross Kirsches Stahl x Panzer gave no truly resistant segregates. The cross Chinese 165 x Panzer yielded certain new resistant combinations.
In the progeny of the cross Chinese 166 (immune) x Strubes Squarehead immunity was linked with undesirable characters, chief among these being insufficient strength of straw. Apart from this some of the segregates are promising, one of them combining immunity with winter-hardiness and good yield.

The F 2 of " Michigan Bronce " x Chinese 165 contained 365 resistant : 101 susceptible ; resistance was incompletely dominant but seemed to depend on one factor. On the other hand, crosses with Chinese 166 fit into no Mendelian scheme and ratios vary from 10·2 : 1 to 6·1 : 1, with again a large number of intermediate forms. The resistance of Chinese 166 itself was less complete than that of Chinese 165.

In a cross of summer wheats using Normandie as the resistant parent and Peragis as the susceptible, clear 3 : 1 ratios were obtained, with resistance recessive and very few intermediate forms. Normandie with other less fully susceptible varieties gave not such clear ratios. These results were fully confirmed in the F_3.

Puccinia triticina.

One of the Normandie crosses was also examined for reaction to *P. triticina*, Normandie being somewhat resistant also to this rust. Resistance was dominant and appeared to be dependent on one factor (2·2 or 2·37 : 1). The excess of heterozygotes is ascribed to the fact that the behaviour of Normandie is rather uncertain. However, the breeding of a spring wheat resistant to *P. glumarum* and *P. triticina* by use of Normandie is regarded as a relatively simple matter.

The nature of the intermediate forms occurring in almost all crosses is a matter for further study.

339. **McFadden, E. S.** **633.11–2.452–1.521.6:575.127.2**
633.11 Hope

A successful transfer of emmer characters to *vulgare* wheat.

J. Amer. Soc. Agron., 1930, **22**, 1020–34.

In a cross between Yaroslav emmer (*T. dicoccum*) and Marquis, only one F 1 plant was obtained. This displayed considerable resistance to stem and leaf rust ; it was partially sterile, but 100 shrivelled seeds were produced.

In F 2 there was a very great diversity of types, all the *vulgare* types were susceptible, most of the emmer types resistant.

The seed of the F 2 was bulked and a large F_3 grown, of which the seed was subjected to mechanical treatment to eliminate any but the plump seeds which represented those which had not suffered from disease attack. From this a large F_4 was grown and six plants of this generation appeared to be true common wheats possessing all the desired characters of the emmer. These were grown on for a number of years and selection continued. Some selections shewed considerable resistance to drought, others to damage by hail on account of their wiry straw and heavy chaff, some to tip-burn, less to anthracnose, black chaff and root rot ; they were completely resistant to the most virulent forms of stem rust.

Some of the selections had high baking quality. The selections were found to possess physiological resistance to most forms of the rust and stomatal resistance, which made them immune to all forms in the mature plant stage. The most promising of the selections was named " Hope." It is very resistant to lodging and shattering, to loose smut and stinking smut (more than either of the two parents). The bran is particularly easy to remove, a character which may be of value in milling.

There are certain disadvantages, such as susceptibility to anthracnose, black chaff and root rot, low yield under intensive conditions, lack of frost resistance ; it has 42 chromosomes and crosses with perfect ease with *vulgare* wheats and these undesirable qualities should be capable of being removed by crossing.

340. **Pelshenke, P.** **633.11:664.641.016**

Beiträge zur Bestimmung der Backfähigkeit von Weizen und Weizenmehlen. (Notes on the estimation of the baking quality of wheat and wheat flours.)

Arch. Pflanzenbau, 1930, **5**, 108–51.

A full discussion of the conception of baking quality, of the methods for its estimation and comparisons of the results with baking tests.

It is pointed out that baking quality depends on at least three factors : namely, quality of gluten, protein content and fermenting power, all of which are hereditary. The objects in breeding must be increased quality of gluten and protein content.

341. **Scharnagel, T.** **633.11:664.641.016**
Die Bedeutung der Backfähigkeit des Weizens für unseren zukünftigen Weizenbau. (The importance of the baking capacity of wheat for our future wheat cultivation.)
Landw. Jahrb., 1930, No. **5** and **6**, 37–50.
Amount of protein is to a certain extent a varietal character, but is influenced by climatic conditions. Wheats which are allowed to ripen thoroughly have a higher baking value than those harvested too early. In most cases increased application of nitrogenous manures increases the protein and gluten content, but reduces the baking number. Breeding for vitreousness and thereby for higher gluten content is not correlated with an improvement in baking capacity.

342. **Åkerman, Å.** **633.11:664.641.016:575(48.5)**
Ueber die Backfähigkeit schwedischer Weizensorten und die Möglichkeit ihrer Verbesserung durch Züchtung. (The baking quality of Swedish wheats and the possibility of improving it by breeding.)
Der Züchter, 1931, **3**, 1–8.
The yield of wheat in Sweden has increased by 30% since the end of the last century as a result of breeding. With this increased proportion of local wheat, it has become essential that it should be of good baking quality.
The methods employed for testing the baking quality are those of Berliner and the more recent method of G. Molin. Amongst the winter wheats the best quality was always exhibited by the old, unselected land wheats (Sammet wheats), which were still inferior to the hard wheats from America and Rumania. The Swedish hybrids were distinctly inferior again ; of these the best was Svea II, which is descended from the common Sammet wheat, having 20% higher yield and is winterhardy and early ; its hectolitre weight is low however, and it has been crossed with Sun wheat to improve this.
The spring wheats are found to have a better baking quality ; Extra Kolben was one of the best of these.
In order to improve the quality of the winter wheats, they are being crossed with the American and Rumanian wheats and numerous other foreign wheats of high quality.
The summer wheat, Diamant, is very rich in protein, but of a poor quality ; by crossing it with the high quality Kolben wheats great improvement has been effected.

343. **Åkerman, Å.** **633.13 Goldenrain II**
Svalöfs Guldregnshavre II (Svalöfs Goldenrain oats II.)
Sverig. Utsadesforen. Tidskr., 1930, **40**, 9–11.
A new variety of the Goldenrain type superior to the old Goldenrain in yield-capacity and grain quality. The yield of this variety of oats compared with that of Goldenrain I, Seger and Arla over varying periods in different parts of Sweden, shews an increase of about 6% over Goldenrain I.

344. **Hanna, W. F., and Popp, W.** **633.13–2.451.2:576.16:575.12**
Relationship of the oat smuts.
Phytopathology (Abst.), 1931, **21**, p. 109.
Only plants inoculated with monosporidial cultures of opposite sex produced smutted heads. If one was of *Ustilago avenae* (loose) and the other of *U. levis* (covered), the infected heads resembled *U. avenae* although somewhat variable.

345. **Bredemann, G., and Heuser, W.** **633.14:575.125**
Beiträge zur Heterosis bei Roggen. (Note on heterosis in rye.)
Z. Züchtung, 1931, A. **16**, 1–56.
The yield of the hybrid generation of a cross between two varieties was compared with higher and lower yielding parents and with the mean of the two parental yields. Mixed cultures of equal parts of the two parental varieties were also compared.

A detailed description of the experiments in each year from 1922 to 1928 is given. In experiments covering some five and some six years the average yield of F1 was greater than the better parent in yield of grain and of straw ; in 16 cases the difference was significant, in three cases not ; the combination Jäger x Probsteier was the only exception. Taking the individual years, in some years the increase of the F1 was greater than in others and in some years it was less than that of the higher parent.

Five different combinations of varieties were used ; in one combination, v. Lochow x Jäger, the F1 exceeded the higher parent in all experiments in all six years, in other combinations an excess occurred in not more than 50% of the experiments.

The individual years differed markedly in the amount of heterosis occurring ; four years were good " heterosis years " whilst in three other years the F1 was often less than the higher parent.

In five other combinations which were studied for only one or two years, only two shewed an excess of the F1 over the higher parent in yield of grain and none for yield of straw. These results must be largely discounted, however, since at least one of the years was a bad " heterosis year."

The yields of a mechanical mixture of equal parts of each parent were found to coincide with the mean yield of the two parents. The hybrid generation obtained from such a mixed population, however, in all five combinations shewed an increased yield. The combination Jäger x Probsteier here, as previously, did not shew this effect. Six of these experiments were done in good, nine in bad, " heterosis years " ; the nature of the year as indicated by these experiments agreed with that observed in the previous case.

Tests were also made in which in place of the parental varieties obtained afresh from the seed-merchant for comparison, the self-fertilized progeny of the actual populations used for the cross, grown under conditions as nearly as possible identical with those for the F1, were used. In all varieties but one, this self-fertilized progeny gave significantly higher yields than the original populations. These differences, however, were not enough to account for the original yield increases of the hybrid population, which remained significant after corrections had been made for the " acclimatization effect."

F1 seed of the same combinations was obtained from various institutes ; of this only in the case of v. Lochow x Jäger was there an increase over the higher yielding parent. When the individual F1's from different sources were examined separately, they were seen to differ very much, some giving considerable increases and others even decreases. This again indicates that the expression of heterosis is influenced by conditions of development. It is possible that in certain seasons and in certain places conditions are more favourable than in others for cross-fertilization ; this is a further argument against drawing conclusions from experiments carried out over a limited number of years.

The increase in yield of grain of the F2 was in general somewhat less than F1 and in certain cases the yield was even less than that of one or both parents. On the other hand, in some cases the F2 yield was greater than F1. In the case of the straw it was found that where the F1 shewed an increase the F2 was higher still, whilst a decrease in F1 was also magnified in F2.

The F3 in all cases shewed a reduction in vigour compared with the F1, although it still in certain cases exceeded one or both of the parents.

The F4 in no case exceeded both parents, but gave yields very little if at all, less than the higher of the two parents, and was always considerably better than the lower parent.

The F1, still more the F2, shewed a greater vigour of growth and assimilatory surface than the parents, especially in the early phases of development.

In general the 1,000 corn weight rose and fell in correspondence with the rise and fall of the yields, but certain exceptions to this rule indicated that other factors than the 1,000 corn weight were involved in the yield differences.

The second part of the paper, pp. 50–56, describes the later work of the second author, covering the period 1928/30.

The F1's from each parent were examined separately so as to get a better insight into the way in which yield increases were brought about and to discover that combination of parents giving the greatest increase. Similar results were obtained, the heterosis could be observed quite early in

the young plants in the field. The yield increase was found not to be dependent on increased tiller production.
The varying expression of heterosis in different years appeared to be influenced by various environmental conditions, not only those effecting flowering. The number of grains per ear played a much greater part in the yield increases than either tiller number or 1,000 corn weight. In a cross of two varieties differing widely in yield, the F 1 shewed a smaller number of grains per ear than the parent of higher yield, but increased number of ears and weight of straw, the reverse conditions obtaining in comparison with the parent of lower yield.
Attempts are now being made to cross two short-strawed ryes and produce a variety yielding as well as normal Petkuser rye.

346. **Hess, G.** **633.14:575.22**
Vergleichende zweijährige variationsstatische und morphologische Untersuchungen an Roggensorten. (Two years' comparative investigations of variation statistics and morphology for rye varieties.)
Z. Züchtung, 1931, **A. 16**, 57–72.
The absolute density of the ear and the order of the varieties was almost the same in two years, differing very much in weather conditions.
The relative position of the varieties with regard to length of straw remained rather constant and the degree of variability of this character also seemed to be characteristic of the varieties.
The number of spikelets and of grains was relatively more influenced by weather conditions and less by variety. Hence these are of rather less value as varietal characteristics.
The length of the spike is also to a certain extent a constant character of diagnostic value, whilst the notchiness of the rachis is of distinctly less value except in certain extreme cases ; the number of sterile spikelets was of doubtful value.
Of the morphological characters, the form of the ear was considered too variable for use as a varietal character, also the hairiness of the stalk.
The number of three-flowered spikelets was of rather doubtful value, as was the nature of the hairs on the glumes and rachis segments.
There are strong indications that a detailed study of the growing plant will furnish valuable varietal characters.

347. **Sprague, G. F.** **633.15:538.6**
Some genetic effects of electromagnetic treatments in maize.
Anat. Rec., 1930, **47**, p. 382.
The selfed progeny of plants whose pollen had been exposed to an electromagnetic field shewed a few recessive mutations, produced at increased rates. F 2 data suggested certain translocations or chromosome attachments and duplications.

348. **Lindstrom, E. W.** **633.15:575**
The genetics of maize.
Bull. Torrey Bot. Cl., 1930, **57**, 221–31.
With the exception of certain eight-rowed varieties with 21–28 chromosomes, maize is relatively free from abnormal cytology.
The behaviour of the characters whose inheritance has been investigated up to date is summarized and tabulated.
Every portion of the plant appears to be subject to genetic modification on Mendelian lines, the total number of genes known exceeding 180. The arrangement of these in ten provisional groups is shewn. The different genes for any one character seem to be distributed at random amongst the chromosomes, chlorophyll variations for instance occurring in seven different linkage groups. Comparatively few 15 : 1 or 63 : 1 ratios occur, which is taken to indicate that ten has been the basic number for a long period of time, in contrast with wheat and oats, where a condition of polyploidy has existed for some time.

The frequent occurrence of true mutation and the different mutation rate for different genes are pointed out. Treatment with X-rays has led to the production artificially of a number of mutations previously known to have occurred naturally and several others not previously known. Some of these are due to gene mutations, others to chromosome irregularities. Genes have recently been discovered which appear to influence the mutability of other genes; these have been alternately explained on the basis of a division of the gene into genomeres which may assort in mitosis of the somatic divisions.
Certain deviations from Mendelian expectation apparently result from differential pollen growth, the presence of certain genes in the pollen stimulating or retarding pollen tube growth.
Triploids have recently been reported and investigated in maize and in hybrids between maize and tetraploid *Euchlaena*. Examination of certain known linkage groups in the latter type of triploid indicates that the differential disjunction occurs in the group of three chromosomes, the one maize homologue being distributed at random, but the two *Euchlaena* homologues tending to separate more often than they remain together.
Certain semi-sterility phenomena which give unusual genetic results are evidently the result of chromosome translocations.
On the whole, inheritance in maize conforms very much to the type established for *Drosophila*, except that crossing over occurs in both sexes. Further investigation is still necessary to arrive at a satisfactory understanding of the phenomena of inbreeding and heterosis.

349. **Brewbaker, H. E., and Hayes, H. K.** **633.15:575.116.4**
Genetic factor relationships in the *B-Lg* group in maize.
J. Amer. Soc. Agron., 1930, **22**, 1035–40.
The two factors were thought to be in the *B-Lg* group. Glossy seedling, Gl_2gl_2 was inherited independently of all other linkage groups except D_1-Pg_2, where linkage studies were not made. The factor *Flfl*, flinty-floury endosperm, was apparently independent of all other groups. The linkage relations and crossing over percentages were studied in the *B-Lg* group and the following order of the genes was established : *Fl-sk-B-*gl_2*-lg*. The relative position of v_4, F1 and *ts* is not yet decided.

350. **McClintock, B.** **633.15:575.116.4**
A cytological demonstration of the location of an interchange between two non-homologous chromosomes of Zea Mays.
Anat. Rec., 1930, **47**, p. 380.
An unequal interchange between the second and third-smallest chromosomes was seen to result in semi-sterility. The two chromosomes were distinguishable morphologically and the interchange could be detected in homozygous plants. At meiosis the homologous portions tended to associate, producing a cross-shaped synaptic complex in which the respective portions could be identified.

351. **McClintock, B., and Hill, H. E.** **633.15:575.116.4**
The cytological identification of the chromosome associated with the *R-G* linkage group in Zea Mays.
Genetics, 1931, **16**, 175–90.
Plants of the chromosome number $2n + 1$ which were known to be trisomic for the chromosomes containing the *r-g* linkage group were examined.
Only one-third, instead of half, of the eggs carried the extra chromosome. The extra chromosome tends to get lost in certain cases when it occurs as a univalent.
With *RRr* plants for red aleurone backcross ratios through the pollen were obtained agreeing closely with the expected 2 : 1; and crosses of $2n$ plants of the constitution *Rr* x $2n + 1$ plants of *RRr* gave the expected 5 : 1. Similar agreement with expectation was obtained in backcrosses of *Rrr* individuals. Microspores carrying 11 chromosomes were examined and the extra chromosome was identified as the smallest chromosome of the haploid complement.
The presence of the extra chromosome made no difference to the outward appearance of the plant. A further plant, which was seen to be trisomic for the smallest chromosome, was examined

genetically and proved to be of the constitution *Rrr* and still another trisomic plant proved to be *RRr*.
Megaspore material was less easy to examine on account of the irregularity of distribution of the extra chromosome. This exact distribution was examined by pollinating with *rr* normals and it was seen that lagging occurred in one-third of the individuals. This assumption was probably satisfactory to explain the results of selfing the trisomic individuals.
Genes located in each of the nine remaining linkage groups were inherited in a normal manner and not influenced by the trisomic chromosome. This proves the independence of the *r-g* linkage group.

352. **Mangelsdorf, P. C., and Reeves, R. G.** **633.15:575.127**
Hybridization of *Tripsacum* with Zea Mays and *Euchlaena Mexicana*.
Anat. Rec., 1930, **47**, p. 378.
Hybrids of maize with *Tripsacum dactyloides* can only be made if the maize styles are cut down to a length of half an inch, corresponding to the style length of *Tripsacum*. Very large quantities of seed can be secured by still further shortening the style, but most of the plants fail to mature. The chromosome number shews that the plants are true hybrids.
Similar methods have led to the hybridization of *Tripsacum* and *Euchlaena Mexicana*.

353. **Brink, R. A.** **633.15:575.14**
Some problems in the utilization of inbred strains of corn (Zea Mays).
Amer. Nat., 1930, **64**, 525–39.
The ultimate object of the method of inbreeding is to eliminate all the undesirable characters and combine the desirable characters in one strain. When this is accomplished the final high-yielding strain should be self-perpetuating and not suffer from loss of vigour on inbreeding.
The relative merit, from a practical point of view, of the single cross, double-cross and three-way methods are indicated. A further method deserving attention is to take four inbred lines in the usual way and cross them in pairs; each lot of hybrids is grown separately and perpetuated from year to year, furnishing parents each year for crossing for production purposes. The only disadvantage of this method would seem to be the loss of uniformity of the seed ears in the combination. The equilibrium in the hybrid populations might be lost after a number of years and fresh crosses would have to be made.
A gene has been recently discovered which prevents all pollination by foreign pollen, the line containing the gene being sterile to any pollen but its own, whilst at the same time furnishing fully fertile pollen capable of pollinating itself and other lines. It is suggested that the introduction of this gene into populations which are to be used for crossing would be a valuable aid in the maintenance of purity.
Another device is suggested whereby any contamination could be detected if it occurred; most commercial varieties have colourless aleurone owing to the lack of the *R* factor for colour, the *A* and *C* factors usually being present. If a new strain were put on the market containing *AA* and *RR* but no *C*, then any contamination with foreign strains would bring in *C* to produce colour. Other possible methods for preventing contamination are mentioned, one of which involves a chromosome translocation, such that partial sterility is produced whenever the line crosses with other lines.

354. **Stadler, L. J.** **633.15:575.24**
The frequency of mutation of specific genes in maize.
Anat. Rec., 1930, **47**, p. 381.
The frequency of mutation was determined for eight genes of well-known and typical genetic behaviour (*C, I, Pr, R, Sh, Sn, Wx* and *Y*), none of which had previously been observed to mutate. Mutations were observed for all genes but *Wx*, the frequency per million varied from 400 for *R* to less than one for *Sh*. The frequency of mutation differed for the same gene in different stocks. X-ray treatments sufficient to produce recessive mutations for seedling characters had no apparent effect on the rate of mutation of the genes under investigation.

355. **Goodsell, S. F.** **633.15:575.243:537.531**
The relation between X-ray intensity and the frequency of deficiency in the maize endosperm.
Anat. Rec., 1930, **47**, 381–82.
For each locus the frequency of deficiency is directly proportional to the intensity of the dose, the loci *A*, *C*, *Wx* and *Sn* being chiefly investigated.

356. **Collins, G. N.** **633.15:576.16**
The phylogeny of maize.
Bull. Torrey Bot. Cl., 1930, **57**, 199–210.
The normal haploid chromosome number for *Zea* is ten, but certain forms are known to have one or two additional chromosomes. Other genera of the group also have ten, *Euchlaena perennis* 20, and certain types of *Tripsacum dactyloides* have 36, whilst others have 18. There seems to be little connection between the chromosome number and phylogeny. So far the only forms with the double number which have been found in *Euchlaena* and the sorghums are perennials.
The possibility of maize having existed as a wild plant is dismissed as improbable. An objection to the idea of an origin by mutation is that crosses of maize and *Euchlaena* give a series of intermediate forms, whereas characters arising by mutation behave as unit characters. An origin by human selection from *Euchlaena* is regarded also as improbable, *Euchlaena* being a highly inappropriate subject.
It seems more probable that the two species have been distinct since the origin of the *Tripsaceae* from some perfect flowered form, except that this would fail to account for their interfertility.
The author leans towards the idea of a hybrid origin, with *Euchlaena* as one of the parents.

357. **Jones, D. F.** **633.15:577.84**
The change from monoecism to dioecism in maize.
Anat. Rec., 1930, **47**, p. 377.
A single recessive factor, silkless, produces sterility in pistillate flowers, such plants being functionally males. A recessive factor, tassel seed, changes staminate flowers in the terminal inflorescence to pistillate, leaving the lateral inflorescences unchanged. Such plants are functionally female.
The F 1 plants from pistillate x staminate plants are normal hermophrodites, segregation occurring in F 2, the double recessives being pistillate ; these when crossed with staminate plants, homozygous for silkless but heterozygous for tassel seed, result in only pistillate and staminate plants.
The importance of these results is that a monosexual organism has changed to a bisexual organism under experimental control.

358. **Koehler, B., and Holbert, J. R.** **633.15–2(73)**
633.15–2–1.521.6:575
Corn diseases in Illinois ; their extent, nature and control.
Bull. Illinois Agric. Expt. Sta., 1930, **354**, 164 pp.
Contains a brief section on the development of resistant strains, in which the difficulties resulting from cross-pollination are pointed out. Continuous selection or the development of inbred strains followed by hybridization between them are shewn to be the only remedies.
A number of important points to be observed in making selections are mentioned. In addition to strains resistant to various diseases, strains whose stalks do not break and strains which stand erect until husking time have been produced by these methods.

359. **Smith, G. M., and Trost, J. F.** **633.15–2.482–1.521.6:575**
Resistance in sweet corn to *Diplodia zeae*.
Phytopathology (Abs.), 1931, **21**, 128–29.
Sweet corn is apparently inherently as resistant to ear rot as dent corn.
Inbred lines selected solely for horticultural performance during the first five years of inbreeding were not so free as those selected for resistance throughout.
Hybrids from two single-cross hybrids which were highly susceptible frequently shewed resistance.

360. **Marston, A. R.** **633.15–2.7–1.521.6:575.1**
Breeding corn for resistance to the European corn borer.
J. Amer. Soc. Agron., 1930, **22**, 986–92.
A South American strain of maize proved highly resistant to the corn borer, *Pyrausta nubilalis* Hbn., as the moths did not lay their eggs in it. It was crossed with various strains of dent corn. The F_1 was quite susceptible, but the F_2 much less so, shewing that segregation had occurred; the results indicated a monohybrid segregation. Resistant lines are being inbred for use in future breeding.

361. **Nilsson-Ehle, H.** **633.16 Opal**
Opalkorn. Stråstyv, högt avkastande sort. (Opal barley. A stiff-strawed high-yielding variety.)
Sverig. Utsädesfören. Tidskr., 1930, **40**, 7–8.
Opal barley, the result of a cross made by Westergaard of Gull barley x Binder. It has an average yield of 5·5% higher than that of Gull barley. In straw stiffness in the year 1928–29, it has shown itself clearly superior to Gull barley and Binder, but inferior to Seger barley.

362. **Nilsson, G.** **633.16 Asplund**
Asplundskorn. (Asplunds barley.)
Sverig. Utsädesfören. Tidskr., 1930, **40**, 150–59.
A variety of six-rowed barley, selected from Primus barley, and probably the result of natural crossing. In yield it is about the same as Vega barley, but it has small grains. The straw yield is higher than Vega. Its strongest point is its stiff straw. Its distribution is not recommended by the Swedish Utsädesförening, but it is suggested that a combination should be attempted between its character for stiff straw and the large grains of Primus barley.

363. **Sidén, J. E.** **633.16 Svalöfs 01294**
Svalöfs 01294. Ny sort mycket tidigt sexradskorn för Norrland, uppdragen vid Jämtlandsfilialen. (Svalöf's 01294. New variety of very early six-rowed barley for Norrland.)
Sverig. Utsädesfören. Tidskr., 1930, **40**, 143–49.
This variety is the result of selection from a strain of Trångsviks barley. In relation to Vega barley, it has a higher grain yield (6%); stiffer straw; ripens earlier and has the same hectolitre weight. The straw yield and 1,000 grain weight are lower. It is a great improvement on the native varieties. On account of its stiff straw and early ripening, its relative yield is highest in less favourable years.

364. **Schiemann, E.** **633.16:575.242**
Ueber eine praktisch und phylogenetisch wichtige Mutation bei Gerste nebst einigen Bemerkungen über Mutation bei Getreide. (On a mutation of practical and phylogenetic importance in barley and some remarks on mutation in cereals.)
Ber. deuts. Bot. Ges., 1930, **48**, 477–89.
A résumé of the cases of true mutation reported in various cereals is given.
A description is then given of an abnormal plant found in 1910 in a field of Bethge III barley. The plant was small, with stiff straw and bore extraordinarily large rounded grains. It is a perfectly new and characteristic type and there seems to be no doubt as to its origin by mutation. It gave a uniform progeny.
Crosses were made with Bethge II barley. From the F_3 five plants were selected for standing capacity. A number of plants of the type of the original mutant (named Viktoria) also appeared in F_3 and later generations. In F6 a pure line of such plants was obtained, differing in certain respects from Viktoria itself; this line is described and the characters of various lines of Bethge given for comparison.
The mutant barley is valued even more for its short awns than for its short stiff straw.

365. **Barbacki, S.** **633.16:581.162.5:575**
Studies on barley. I. Some problems on variability and inheritance of morphological characters.
Mem. Inst. Polon Ec. Rur., 1929, **10**, 126–62.

Differences between the six- and two-rowed forms were dependent on two factors, two-rowed forms being given the formula *ZZ ww*, six-rowed *zzWW* or *zzWw*, and *intermediums Zzww*, *ZzWw* and *ZzWW*. The factor *W* increases the fertility of the lateral florets and *ZzWW* plants thus have a greater number of fertile lateral florets than *ZzWw*, which, in turn, is greater than *Zzww*. The intermediate forms thus constitute three genetically distinct groups.

The segregations had a strongly intermediate character. The presence of cumulative factors is indicated for length of spike and of straw, number of spikelets and tillering. There was one factor for greenish-brown v. yellow grain and for common v. naked grain. Correlations existed between type of spike and length of awns, spike and straw, and number of spikelets. All these characters are less developed in six than in two-rowed types, the *intermedium* types being intermediate.

From 50 to 100% increase in variability of the morphological characters was brought about by crossing.

366. **Dietz, S. M.** **633.16–2.421–1.521.6:575.1**
The varietal response and inheritance of resistance in barley to *Erysiphe graminis Hordei* P.F. 4.
Iowa J. Sci., 1930, **5**, 25–33.

Tests were made on 90 varieties of barley with physiological form 4 of the fungus; great differences in reaction were apparent, four varieties being quite free from attack. Crosses were made between resistant and susceptible varieties, the F_2 and F_3 results showing monohybrid ratios with susceptibility dominant.

367. **Isenbeck, K.** **633.16–2.484–1.521.6:576.16:575**
Untersuchungen über *Helminthosporium gramineum* Rabh. im Rahm der Immunitätszüchtung. (Investigations on *Helminthosporium gramineum* Rabh. bearing on breeding for immunity.)
Phytopath. Z., 1930, **2**, 503–55.

This is a revision and amplification of a previous work by Genau, based on a large number of infections carried out in the years 1926–30. By keeping the material at a temperature of 0–5° C. it was possible to retain it for a considerable time (over one year) and so carry out infections during the whole year. The methods of wet and dry flower infection, seedling infection and grain infection with spores or mycelia are described. For ordinary purposes and variety tests, field infection was preferable, but for inheritance tests the greenhouse infection was better in that it gave a more accurate indication of the absolute resistance and a more uniform and severe infection.

Considerable differences in reaction were noted amongst the varieties tested, infection varying from 19·2–91·6%. Early varieties on the whole were more susceptible than late. The type of reaction associated with the various groups of barley is described.

Tests on similar lines were made of the progeny of eight crosses with different combinations of immunity, resistance and susceptibility in the parents. Only the flowers of the F_2 plants were infected, giving ratios thus for the F_3. The F_4 generation was also examined. All crosses were tested by the method of wet infection, two also by dry infection, and one F_3 was also tested in the greenhouse by infection of the grain. In F_2 and F_3 there was no sharp distinction between infected and non-infected. Immunity seemed to be dominant; in crosses between two immune varieties no susceptibles appeared but crosses of two resistants shewed transgression in F_2, some susceptible individuals appearing. Transgression also occurred in crosses of two susceptible parents.

It is clear that the number of resistant individuals in the progeny increases with the degree of resistance of the two parents. The presence of a large number of factors is indicated.

The American forms of the fungus gave colourless mycelia, the German forms green or red-brown. Differences were also noted in form of the mycelium and in ring formation. By testing a large number of cultures from different sources on artificial media under identical conditions, three distinct forms of the fungus were established with minor differences within the three groups. Infection tests shewed that the different cultures differed in their capacity to infect the six test varieties, the American forms being less virulent than the German forms. The different forms also differed in specialization.

368. **Huskins, C. L., and Smith, S. G.** **633.174:576.312.32**
Chromosome studies in the genus sorghum.
Anat. Rec., 1930, **47**, p. 382.

Twenty-four species and varieties have been examined cytologically. All except one have the diploid number 20 ; this is *S. halepense* with 40. One pair of peculiar-shaped chromosomes was traced through all the species and some related genera. Polyploid segments of root tips were observed.

369. **Chiappelli, R.** **633.18**
Le varietà di riso coltivate in Italia, e cenni sulla botanica, sulla genetica e sulla selezione. (The varieties of rice cultivated in Italy, and notes on the botany, genetics and selection of rice.)
Quad. Staz. Sper. Risicolt. Vercelli, 1930, **9**, 136 pp.

The first part of this monograph contains a general description of the rice plant with a short account of methods of selection and hybridization. The question of the occurrence of natural crossing is discussed and Farneti's view of its impossibility is negatived by the results of numerous workers and the observations of the author.

The rest of the work is taken up by descriptions of the most important varieties of rice now cultivated in Italy. There are photographic plates of the panicles and of the grain, both enclosed by the glumes and husked, of each variety. The notes include a morphological description of the plant, and its biometric characters, such as height, number of grains, length of the panicles, weight of 1,000 grains and dimensions of the grain, etc.—its origin and yield and the conditions best suited to its cultivation.

370. **Torres, J. P.** **633.18:575(91.4)**
Progress Report on rice hybridization at Alabang Rice Experiment Station.
Philipp. J. Agric., 1930, **1**, 287–92.

A number of unsuccessful crosses are mentioned, followed by more recent ones which succeeded. In the cross Lampadan x Sipot, the bearded character was dominant. The object was to combine the yield of the latter with the table quality of the former. From the F_2 78 plants were selected and are now under observation.

Other crosses of a similar nature are in progress.

Certain crosses presented a curious occurrence of sterility and the inheritance of this is being studied. Fertile and semi-sterile plants segregated in F_2.

A number of crosses for resistance to *Sclerotia* are also in progress.

371. **Chiappelli, R.** **633.18:581.162.32**
Sull' incrocio naturale nei fiore di riso e metodo per favorirlo. (On natural crossing in flowers of rice and a method of encouraging it.)
Giorn. Risicolt., 1930, **20**, pp. 109–13.

In a natural cross between early and late forms, the hybrid plant was more like the early parent, in F_2 there were three late and one early ; in F_3 there were plants seven to ten days earlier than the early parents with good quality and yield.

Other characters often obtained in natural hybrids, are greater height and thicker stems, resistant to lodging. In a number of crosses with a lodging-resistant variety *Ukeai*, all the hybrids retained this quality. Great variation occurred in quality, colour, height etc., in the hybrids.

372. **Tschermak, E.** **633.3:575.183**
Über Xenien bei Leguminosen. (Xenia in *Leguminoseae.*)
Z. Züchtung, 1931, **16**, 73–81.
In many *Leguminoseae* the change in colour of the seed tissue resulting from cross fertilization is masked by the seed coat. When this is removed, it is seen in many species that out-pollination is more frequent than was thought. Such characters are often important in that they are an indication of economic characters such as flavour, with which they seem to be associated. xenia can sometimes be observed in other characters such as size of seed and cases are pointed out. A number of cases in which cross pollination affects the characters of the fruit are mentioned. A difference in behaviour of the two bean crosses is pointed out, in one of them the size of the hybrid seeds is entirely determined by the mother plant, in the other the size is also influenced by the male parent. Some kind of hormone action on the part of the female parent is supposed to be present in the former case, preventing the occurrence of xenia, and absent in the latter. The author also discusses cases in which an apparently simple 3 : 1 colour ratio is also influenced by the secondary segregation of certain enzyme factors acting to a certain extent on the main colour factor.

373. **Munerati, M. O.** **633.41–1.547.4**
Lacunes et points obscurs sur le problème de la montée en graine de la betterave pendant la première année. (Gaps and obscure points in the problem of bolting of beet.)
Bull. Assoc. Intern. Sélect. Pl. Grande Cultures, 1930, **3**, pp. 175–78.
In view of its economic importance singularly little work has been done on this subject. The author leans towards the view of de Vries that each plant has a tendency, characteristic of the species and incapable of suppression, to seed in the first year. A number of ideas on the influence of various factors on this character have never been experimentally confirmed.

374. **Kočnar, K., Hampl, J., and Šmerda, J. H. V.**
633.416:581.192:578.081
Příspěvek k oceňováni kořenů krmmé řepy k účelům šlechtitelským. (Note on the evaluation of the forage beet for selection.)
Sbornik Československ. Akad. Zeměd., 1931, **6**, 95–132.
The forage beet shews a greater tendency to inversion than the sugar beet and the determination of the sugar by polarization is not therefore so accurate.
The dry materials are estimated by refraction. The distribution of food materials and the percentage of soluble dry matter varies very much in different shaped roots of the same variety. It is much more difficult to know in what position to take samples than in sugar beet.

375. **Karpechenko, G. D.** **633.42:575.127**
(A contribution to the synthesis of a constant hybrid of three species.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed., 1930, **2**, 277–94.
The constant *Raphanobrassica* hybrid crossed with six different species with which the parental species do not cross. These hybrids are " triheterogenom," containing the chromosome sets of three distinct species.

376. **Karpechenko, G. D., and Shehavinskaia, S. A.** **633.42:575.129**
(On sexual incompatibility of tetraploid hybrids.)
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed., 1930, **2**, 267–76.
The fertile, tetraploid *Raphanobrassica* constant hybrid crosses only with difficulty with its parental species, although the diploid F 1 crosses with ease with them. This and many other considerations point to its being a distinct species.

377. **Asseyeva, T. O.*** **633.491:575.247**
(Vegetative mutations in the potato.)
Proc. U.S.S.R. Congr. Plant- and Animal-Breed., 1930, **2**, 141–54.
It was found that by removing the eyes from many mutant tubers, the plants which develop resemble not the mutant but the normal from which the mutant arose. The reason for this behaviour is found in the fact that the mutants have arisen by vegetative mutation in the epidermal tissues only. In certain cases the subepidermis mutated and in others again both these layers. The genetic behaviour of the various types agreed with these explanations, the mutant type being inherited only in the case when the lower layers were affected.
The relative frequency of loss mutations and gain mutations was approximately equal.
Certain phenomena of speckling also observed in a number of South American varieties suggest a somewhat similar explanation.

378. **Heyn, H.** **633.491:576.3**
Beitrag zur Cytologie der Kartoffel. (Contribution to the cytology of the potato.)
Wiss. Arch. Landw. Abt. A. Pflanzenbau, 1930, **4**, 123–68.
In all the varieties investigated the chromosome number 12/24 was observed, although the number in pollen mother cells varied between 21 and 25, and somatic plates contained up to 50.
The reduction division and pollen formation are described. Few varieties form normal tetrads, dyads are more frequent and triads also occur. In other cases the pollen is quite deformed and abnormal in varying degrees.
Dyads are frequently formed by two metaphase II plates uniting instead of dividing, resulting in diploid gametes. This probably explains the fact that certain other authors have reported the observation of tetraploidy in certain varieties.
Dyads are sometimes formed also by premature division in the homeotypic division and failure to separate to the poles. An examination of the pollen shews large pollen grains corresponding to the dyads.
A failure of normal spindle formation, followed by disturbed or abnormal division of the cells and other irregularities, brings about degeneration and ultimate death of the pollen. Other abnormalities of division produce pollen grains of various sizes.
Varieties are grouped according to their relationships or parentage and the formation and character of the pollen in each case is described for 54 varieties. The degree of irregularity was found to be typical for individual varieties.
Those varieties which produce the least amount of pollen have, as a rule, the highest proportion of dyads. It seems as if the production of dyads were the cause of the pollen sterility. It is significant that in spite of the diploid dyads no polyploid forms have been produced by hybridization.
Temperature differences between 13° and 24° had no effect on the disturbance.

379. **Longley, A. E.** **633.491:576.312.3:581.331.2**
Chromosome behaviour and pollen production in the potato.
J. Agric. Res., 1930, **41**, 867–88.
Cytological investigations were made on 38 commercial varieties of *Solanum tuberosum L.*, of ten wild species and two unnamed seedlings. The basic haploid number is taken as 12, since no form with less than 12 chromosomes is known. Four wild species have this basic number and shew regular meiotic divisions, as do the F_1 and F_2 hybrids between two of the species.
Two species were triploid (18), with irregular meiotic divisions in which the number of bivalents varied from 12 to 18. Their behaviour was almost identical with that found in the F_1 between a 24 and a 12 chromosome species.

* A full translation of this paper is on the file at the Bureau.

Three species proved to have 24 haploid chromosomes and one 36. These shew regular chromosome behaviour, as also hybrids between two 24 chromosome species.
In general, those species with an even multiple of the basic number shew regular meiotic division whilst the behaviour of the triploids suggest that they are hybrids.
All but three varieties of *S. tuberosum* had 24 haploid chromosomes, but very few shewed regular chromosome behaviour. The three yellow-fleshed varieties from S. America were normal 12 chromosome forms. The remaining 37 tetraploid forms were quite regular in chromosome number, but shewed irregularities in chromosome behaviour of the following types :

1. Some unpaired chromosomes among the bivalents but both first and second reduction divisions usually occur.
2. Frequent unpaired chromosomes, occasional cells shewing no pairing, some cells go through one division only.
3. Pairing variable, second division rare and absence of pairing frequent.
4. Large numbers of cells shewing the somatic chromosome number and true meiosis often absent; the nucleus degenerates in prophase or metaphase and cell division is amitotic.

The quality of the pollen produced by a species becomes gradually worse in passing from the first of these groups to the last. No difference could be detected in groups 3 and 4 in different years but the species in the other classes varied considerably from year to year, so that in some years all these species produced more good pollen than in other years.
The author suggests that these irregularities point to the origin of the tetraploid potato by chromosome doubling after a cross between two 12 chromosome species, whose chromosomes were incompatible and would not pair, and that a number of these hybrids have been preserved by vegetative propagation. The occurrence of polyploid series and hybrid forms amongst the wild species lends support to this suggestion.
The yellow-fleshed types are apparently not of the same hybrid ancestry and the author supports the view of a polyphyletic origin of the cultivated potato.

380. **Reddick, D.** **633.491–2.111–1.521.6:575**
633.491–2.411.4

Frost-tolerant and blight-resistant potatoes.
Phytopathology, 1930, **20**, 987–91.

Plants of *S. demissum* (*S. utile* Klotzsch) were resistant to frost as were also first generation hybrids of this species with the susceptible species *maglia* and *lendlerii*. Frost tolerance also occurred in certain specimens, *S. commersonii* Dunal and its hybrids. *S. utile* and its hybrids are resistant also to blight *Phytophthora infestans*.

381. **Reilung, H.** **633.491–2.4**
Eine züchterische Studie zur Dürrfleckenkrankheit der Kartoffel. (A study of early potato blight from the point of view of breeding.)
Der Züchter, 1930, **2**, 317–24.

It is shewn that the F1 generations from different parental combinations differ in degree of infection, early varieties tending to produce offspring susceptible to the fungus *Alternaria solani varians*.

382. **Kearney, T. H.** **633.51:575.11**
Genetics of cotton.
J. Hered., 1930, **21**, 325–36, 375–84, 409–15.

A summary of the more important work done on cotton genetics and the views of different authors. Reference is made to Harland's results relating to the difference in modifiers in interspecific crosses and to the small number of mutations; also to the few cases of monohybrid and

dihybrid inheritance, the small amount of information on linkage relations. A list of the characters so far indicated as allelomorphic pairs is given, after which each pair is discussed in turn and its inheritance described. The characters dealt with in this way are : crinkle leaf dwarf (single gene mutation, recessive), short fruiting branch (no dominance), chlorophyll deficiency (apparently three factors), red leaf (one factor which may also influence flower colour), leaf pulvinus colour, leaf shape (whose behaviour varies with the species crossed), Hutchinson's broad-lobed bud mutant, petal colour (numerous factors and modifiers), petal spot (full spot one dominant factor influenced by modifiers), pollen colour (3 : 1 in intraspecific, intermediate inheritance in interspecific), boll apical furrow (results conflicting, apparently two dominant factors for absence of furrow), boll colour, boll pubescence (perhaps two recessive factors), seed fuzz (naked dominant to fuzzy tip and to full fuzz) ; there seem to be various allelomorphs for different degrees of fuzz ; modifiers operative in interspecific crosses, one sometimes altering conditions of dominance ; green fuzz is dominant to white, giving simple ratios in intraspecific crosses.

Sparse lint is linked with naked seed, giving 3 : 1 ratios, abundant lint and fuzzy seeds being dominant. Varying quantities of lint do not give discontinuous inheritance. There is indication also of linkage between leaf colour and certain other characters and three linkage groups have been provisionally established by Harland. These and evidences of linkage from other writers are discussed. A case is mentioned in which a disherent correlation between two characters was repeatedly observed, the combination in the offspring being the reverse of that in the parents. It is thought possible that this may represent a case of more than 50% crossing over.

A number of characters which appear to be inherited independently are enumerated. A bibliography of fifty references is appended.

383. **Vycotski, K.** **633.51:575.127.2**

(Work on interspecific hybridization in cotton at the Turkestan Breeding Station.)

Bull. Sci. Res. Cott. Inst. Tashkent, 1930, **1**, 26–29.

The object of the investigations has been to investigate the possibility of obtaining constant hybrids in wide crosses, which unite the valuable lint characters, yield, earliness, etc., of the respective groups. The new-world cottons, which seem to be natural tetraploids are much superior both in yield and vigour and in lint quality.

Three species took part in the 1929 crosses, viz., *G. hirsutum*, *G. barbadense* and *G. herbaceum*, the object being to combine in one variety the valuable lint character of the Egyptian (*G. barbadense*) and the earliness, strength of lint and high yield of the uplands (*G. hirsutum*) ; and to produce from the cross *G. herbaceum* x *G. hirsutum*, reliable drought resistant productive types with hairy bolls. In all, 75 lines were used, and 75,000–80,000 pollinations were made.

Preliminary observations shew that crosses of groups with the same chromosome number are very easy. Crosses between new and old-world forms, *i.e.* groups with different chromosome number, succeed extremely seldom, certain combinations giving a higher percentage of success than others ; this occurs also in crosses of the same chromosome number. Thus out of 1,000 crosses of No. 169 (upland type) with No. 0671 (*G. barbadense*) 9.330 hybrid seeds were obtained, whilst with No. 0100 (*G. hirsutum*) the same number of crosses gave 3.328 hybrid seeds.

Similar differences were observed in the number of seeds in individual bolls.

That natural crossing between varieties belonging to different chromosome groups also occurs, even without emasculating the female plant, was shewn by certain cultures specially arranged to test this point. The author mentions the results of a number of authors with regard to natural crossing and the factors which influence it but is unable to agree with Dekaprelovitsch that it depends on the variety of cotton.

The percentage of natural crossing between varieties with different chromosome number was not more than 0·003%. All the F1's obtained were sterile both when self-pollinated and back-crossed. Various methods for obtaining later generations are being tried, including the action of certain narcotics.

Methods of utilizing the F1 plant, of improving methods of hybridization and finding the most suitable combinations are in progress.

384. **Zhurbin, A. J.** **633.51:581.162.32**
(Hybridization in cotton.)
Bull. Sci. Res. Cott. Inst. Tashkent, 1930, **1**, 22–26.
The percentage of natural hybridization found by various workers is tabulated and discussed. It is shewn to depend very largely on the spacing, the weather, the variety of cotton. Attempts to breed absolutely self-fertilized types, by breeding short style and other methods have failed. A very short résumé of the history of cotton hybridization is given, ending with a short account of the work of Zaitzev in combining the quality of lint of American cottons with the early ripening necessary for cultivation in Turkestan.

385. **Soltau, F.** **633.52:575.42:575.73**
Untersuchungen über die Wirkung der Auslese in Zuchtstämmen des Leins unter Berücksichtigung der Abbaufrage. (Investigations on the action of selection on flax strains with reference to the question of degeneration.)
Faserforschung, 1930, **8**, 148–95.
Progeny of selected plants of certain strains were compared with the unselected strains and found to be definitely inferior. Certain plants were multiplied under gauze to prevent out-pollination over a number of years. Some proved to be homozygous but many were heterozygous, which shews that the so-called " Zuchtsorte " obtained by individual selection, are frequently not pure lines, the parental plant having been heterozygous as a result of out-pollination.
Continuous single plant selection is necessary for the maintenance of a pure line.

386. **Schilling, E.** **633.52:576.16**
Zur Abstammungsgeschichte des Leins. (The evolutionary history of flax.)
Der Züchter, 1931, **3**, 8–15.
Flax is one of the oldest of cultivated plants. It has never been found in the wild state.
The non-dehiscence of the capsules in the present-day cultivated forms is a disadvantage and can only have been retained as a result of the artificial conditions of cultivation. The author considers that its origin is to be found in the dehiscent flaxes which are fast falling out of cultivation. The oil flaxes with their branched axis and numerous capsules obviously come nearer to the prototype than the fibre forms. Under particular cultural conditions the latter lose their characteristic type of growth.
Linum usitatissimum agrees with *L. angustifolium* in chromosome number ($2n = 30$), whereas other wild species have 18 (*L. perenne* and *austriacum*), 16–17 (*L. grandiflorum*), 30 (*L. flavum*) or 32 (*L. catharticum*). The two species are allied also in factorial constitution and are both homostylous in contrast with the other species. They intercross with ease. *L. angustifolium* itself is made up of a number of varieties, some of which closely resemble *usitatissimum* ; it is known to have been cultivated since ancient times. Certain lines of cultivated flax shew a distinct tendency for the capsules to dehisce and it is thought that the non-dehiscent type may have originated by mutation. By crossing the two types a whole series of intermediates emerge. The difference between oil and fibre forms is supposed to have arisen by natural selection exerted by climate, the oil forms having a longer growth period and thriving in regions with a long summer, the tall unbranched types being produced in northern climates.

387. **Rodenhiser, H. A.** **633.52–2.482:576.16:575.242**
Physiologic specialization and mutation in *Phlyctaena linicola* Speg.
Phytopathology, 1930, **20**, 931–42.
Up to the present 11 forms of the fungus have been obtained, either as original isolations or as mutants. The forms differed in colour, in degree of conidia formation, in their reaction to different temperatures and in pathogenicity, these differences being constant over a considerable period. Reverse mutations occasionally occurred.
Flax varieties ordinarily resistant to wilt and rust were killed by this fungus. A number of commercial varieties and departmental hybrids were examined and some were found to be resistant ; resistance did not seem to be correlated with any particular agronomic type. The breeding of resistant strains should be quite possible.

388. **Bach, W. J., and Taubenhaus, J. J.** **633.524.3–2.4–1.521.6**
The resistance of *Malvaviscus conzattii* (*arboreus*) to *Phymatotrichum* root rot.
Phytopathology (Abst.), 1931, **21**, p. 120.
The plant referred to proves to be much more resistant to root rot than the common *Hibiscus*, cotton, okra, etc.

389. **Catalano, G.** **633.526.2:581.162.52:576.3**
Contributo alla conoscenza delle cause della sterilità in Agave e Fourcroya. (A contribution to the knowledge of the causes of the sterility in Agave and Fourcroya.)
Lav. R. Inst. Bot. Palermo, 1930, **1**, 58 pp.
The development of the megaspore is described for *Agave Sisalana*, *A. Zapupe* and *A. macrantha* and the development and germination of the pollen of *A. Sisalana*. In each case a degeneration of the reproductive cells occurs at varying stages of development leading to complete sterility. In *Fourcroya depauperata* and *F. gigantea* a similar degeneration occurs, but only after the megaspore is ready for fertilization.
It is commonly suggested that the cytological aberrations, which have often been recorded, are indications of the hybrid nature of the plants concerned. The author is of the opinion that other causes are operative, possibly the effect of various external conditions, but chiefly the increased vegetative activity of the plants which is manifested not only in the leaves and stems, but also in the reproductive organs and may lead to a disturbance of the metabolic condition on which sexual reproduction is dependent.

390. **Gioelli, F.** **633.526.2:581.33:576.3**
Ricerche sullo sviluppo del gametofito femmineo e del polline nel genere Aloe. (Researches on the development of the female gametophyte and the pollen in the genus Aloe.)
Lav. R. Inst. Bot. Palermo, 1930, **1**, 24 pp.
A cytological description of the development of the reproductive organs of various species of Aloe.

391. **Barnes, H. F.** **633.584.3–2.7–1.521.6**
Further results of an investigation into the resistance of basket willows to button gall formation.
Bull. Appl. Biol., 1931, **18**, 75–82.
A hybrid variety Harrison, from *viminalis* x *purpurea*, was previously found to be immune. In the more extensive trials reported here, four other varieties proved to be immune, the larvae being unable to develop even if eggs were laid ; no gall formation occurred.
The experiments shewed that all varieties of *Salix triandra* were susceptible, *S. viminalis*, *S. purpurea*, *S. alba* and hybrids of *viminalis* x *purpurea* were immune.
Although immune from *Rhabdophaga heterobia*, these varieties are susceptible to certain other insect pests. It is therefore proposed to hybridize them with *S. triandra*.

392. **Koens, A. J.** **633.61:575**
Improvement of sugar cane varieties.
Int. Rev. Agric. Sci. Prac., 1930, **21**, 129–34 and 193–202.
A brief but comprehensive review dealing with classification, description of species, origin of noble canes, the history of selection and the first hybrids, the production of some resistant canes, of high yielding noble canes and the effort to unite these two qualities with the gradual building up of the famous *P.O.J.*2878, the influence of cytology on recent developments and the production of giant types with increased chromosome number. The canes grown in each of the chief sugar producing countries are given.

393. **Venkatraman, T. S.** **633.61:575(54)**
Problems for the sugar cane breeder. (With special reference to Indian conditions.)
Proc. Congr. Intern. Soc. Sugar Cane Techn., 1930, **3**, 429–51.
One of the fundamental necessities is to investigate the factors influencing arrowing, so as to be able to influence it and induce it in canes which normally arrow only rarely.
To obviate the difficulty of using only plants with sterile pollen as mother plants, measures are being tried whereby sterility may be induced in the pollen, leaving the ovules sound, since it has been shewn that these retain their fertility over a much wider range of conditions than the pollen. This would enable canes to be used as mother plants, which have not formerly been regarded as suitable.
In the author's breeding programme, the importance of testing seedlings under as wide a range of conditions as possible is emphasized, to the need for accurate genetic studies and root development studies, the bearing of certain morphological features of the leaf and stem on disease resistance.
A short account of cane breeding in Hawaii is given in the discussion following the paper.

394. **Hill, A. G.** **633.61:575(92.2)**
Report on a visit to the Proefstation Oost-Java in March–April, 1930.
An account of Bremer's work on the doubling of the chromosomes of *Saccharum officinarum* in interspecific crosses and the influence of these new cytological findings on the crossing work, the attempt to build up strains with high chromosome number for commerce.
The methods of breeding work are described and discussed.

395. **Jeswiet, J.** **633.61:575(92.2)**
The development of selection and breeding of the sugar cane in Java.
Proc. Congr. Intern. Soc. Sugar Cane Techn., 1930, **3**, 44–57.
Of all the canes imported after the sugar cane crisis from the Malay Archipelago, none of the noble canes was immune from sereh, although red Fiji was less susceptible. Many of the canes imported served as parents later on. From India, Chunnee, imported in 1890, proved to be immune. This was crossed with noble canes giving hybrids intermediate in size, with full resistance and some with high sugar content. They were susceptible to mosaic, however, which was just becoming serious.
By crossing the Chunnee seedlings amongst themselves and with *S. officinarum*, hybrids with a higher cane weight were produced.
Soon after this (1893) Moquette and Wakker began using Kassoer cane in a similar way, Kassoer being resistant to both sereh and mosaic.
A little later Jeswiet began classifying the wild and cultivated species of the genus *Saccharum* and a number of his conclusions were supported by the cytological evidence of Bremer. It appeared that all cultivated forms of *S. officinarum* L. were susceptible to mosaic but mostly immune from sereh ; *S. Barberi* Jesw. are also susceptible to mosaic and immune from sereh, whilst many forms of *S. sinense* Roxb. are resistant to both. *S. spontaneum* is immune from both.
Bremer shewed that *S. sinense*, including Loethers, had 49 haploid chromosomes, *S. officinarum* 40, but *POJ*100, which is descended from Loethers, had 89.
A number of crosses were made in 1911, by Miss Wilbrink, of 100*POJ* and Cheribon with Kassoer. The seedlings were useless, but were used as parents. Chunnee and Kassoer were also crossed to combine strong root system and sereh resistance of both, with the mosaic resistance of Kassoer and its hybrids were used more and more in later years for crossing.
In the crosses Cheribon x Kassoer, hybrid 2194*POJ* was outstanding, in Preanger x Kassoer hybrids, 1808*POJ* and in 100 x Kassoer hybrid, 2364*POJ*, which latter was the best mother plant of all. The Kassoer derivatives proved to be much more robust, longer and darker green than Chunnee derivatives and resembled or even surpassed the best cultivated types.

Kassoer was ultimately considered to be a natural hybrid between Black Cheribon and Glagah (*S. spontaneum*) and forms closely resembling it have been built up artificially, having the same number of chromosomes (68). The *spontaneum* parent accounted for its disease resistance and strong root system.
Crossing was then begun using *S. spontaneum* itself on to the Kassoer hybrids to increase the immunity in the offspring.
2364 was after this largely used as a parent ; a cross with *EK*28, in which it was hoped to combine immunity, habit, root system and sugar content with absence of flowering, gave one plant with the desired characters after a number of years' continuous crossing ; it was good in quickness of growth, tillering, erectness of stalks, length of internodes, freedom from lowering, root system, yield and sugar content, immunity from sereh and mosaic, germination percentage, lack of flowering. The pedigree is

Banjermasin hitam ♀ x Loethers ♂ = 100*POJ* ♀ x
Cheribon ♀? x *S. spontaneum L.* ♂ = Kassoer ♂ } = 2364*POJ* ♀ } = 2714, 2722, 2725, 2878, 2883.
*EK*28 ♂ Descent unknown, presumably 100*POJ* x *EK*2

The cane 2878*POJ* has rapidly spread to 90% of the area of cultivation. In 257 tests it was only twice inferior to other Java varieties, carried out on all soil types and in all districts, giving an average increase in production of 35%. Cultivation costs are greatly curtailed by its use.

396. **Posthumus, O.** **633.61:575(92.2)**
On the present state of cane-breeding in Java.
Proc. Congr. Intern. Soc. Sugar Cane Techn., 1930, **3**, 420–28.
The only canes which have been distributed since 2878*POJ* are a few which have resulted from one further hybridization with *S. officinarum*. It is already noted that their resistance is somewhat weaker. Having attained this outstanding variety, further improvement will only be gained by crossing canes of known high merit, in the hope of obtaining canes which surpass 2883 perhaps under special conditions of soil or climate.
New combinations have been made possible by growing varieties in the new stations where they flower more profusely and at different times.
Further crosses are constantly being made with *S. spontaneum* and its hybrids, in the hope of obtaining hybrids better than the original parents of the *POJ* canes.
Crosses with other genera have also been made.

397. **Bremer, G.** **633.61:576.3**
Short remarks on the cytology of *Saccharum*.
Proc. Congr. Intern. Soc. Sugar Cane Techn., 1930, **3**, 403–08.
The basic number for the group *Andropogoneae* is ten. Within the genus *Saccharum*, one form has been found with the haploid number 30, thus hexaploid ; it differed somewhat from other *Saccharum* species and has been assigned by Jeswiet to the species *S. robustum*.
S. officinarum has 40 haploid chromosomes and is thus octoploid. Deviating numbers are found in some *spontaneum* varieties (56), in *S. Barberi* (46) and *S. sinense* (58) ; these are said to result from hybridization and chromosome aberration. Such aberrations have been observed on self-fertilizing Glagah (*S. spontaneum*, $n = 40$) which produces certain giant plants with numbers varying from 48 to 54. Deviating numbers are also found in certain canes of unknown origin, such as Loethers (49) and Naz Réunion (55).
In *S. officinarum* deviating numbers are never observed, but reduction division may be abnormal, leading to pollen sterility. This is very much influenced by conditions of environment.
In the artificial hybrids from the suspected parents of Kassoer (*S. officinarum* with 40 and *S. spontaneum* with 56) 136 diploid chromosomes were counted at anaphase, shewing an increase of 40 chromosomes. As failure to reduce has never been observed in the embryo-sac mother cells

of *S. officinarum*, the author supposes that reduction occurred and that the chromosomes of *S. officinarum* split during fertilization. The Kassoer cane shewed exactly similar behaviour proving the assumption of its hybrid nature. Many of the offspring of these hybrids resembled the F1 plants and also retained the same chromosome number.
When *S. officinarum* is crossed with the *spontaneum* species with 40 chromosomes, the hybrids again have 40 extra chromosomes, giving 120 in all, resembling a Philippine cane with the same number.
Hybrids of Kassoer with *S. officinarum* have 148 chromosomes, indicating a further doubling in the noble parent.
Hybrids of 100*POJ* with Kassoer had 148, others 152 and 157 ; this is a result of the unbalanced condition ($2n = 89$) of 100*POJ*. When these hybrids were crossed with *S. officinarum* there seemed to be no further doubling, although still further irregular numbers appeared. Further, such " nobilizations " tend to decrease the chromosome number again. By further crossing with *spontaneum* followed by back-crossing to noble canes, it is hoped to obtain commercial types with still further increased chromosome number.

398. **Bremer, G.** **633.61:576.3**
The cytology of *Saccharum*.
Proc. Congr. Intern. Soc. Sugar Cane Techn., 1930, **3**, 408–15.
The part played by cytology which was discussed in the foregoing paper is again stressed. The irregularities of division and chromosome pairing which are frequently observed in *S. officinarum* are described and it is shewn that these are intimately related to climatic conditions. Fertile pollen is obtained only when division is regular and results in pollen with 40 chromosomes. In hybrids, however, it was found that pollen grains in which slight deviations of chromosome number occurred might be fertile.

399. **Borden, R. J.** **633.61:578.08**
Experimental technique.
Ass. Hawaiian Sug. Techn., 1930.
Also *Facts about Sugar*, **25**, 834–5.
Results of statistical analysis of field tests shew that increase in size or number of plots will not give greater accuracy unless the variation within the test area is low.
Widely divergent yields from adjacent plots indicate personal error, and for guidance in eliminating these, a " Table of Omissions " is given.
A relatively high degree of accuracy is secured by weighing every third bundle. A sample representing at least 10% of the cane from a plot is necessary to give a reliable juice figure.

400. **Davis, R. L.** **633.61–2.8–1.521.6:575**
Mayaguez 3, 7 and 42—three cane varieties immune to mosaic.
Agric. Notes, P. Rico, 1930, No. 52, 2 pp. (Stencilled).
Certain of the hybrids of *POJ*2725 with *SC*12/4 are very promising, free from the early stooling of the *POJ* parent, but possessing its mosaic resistance. Some are reclining in growth, so escaping damage by winds. They are satisfactory in many other features.
Descriptions of the most promising canes are given.

401. **Archimowitsch, A. S.** **633.63:575.12**
Die Methodik der Isolation und Bastardierung bei der Zuckerrübe. (The method of isolation and hybridization in sugar beet.)
Z. Züchtung, 1930, A. **15**, 357–65.
Sugar beets were planted in rows alternating with garden beets. Plants were isolated from out-pollination with coarse cotton material with 22 threads per cm. The number of cross-pollinations with the garden beets was 1·5% in one year and 0·4% another year.

Single inflorescences were isolated with parchment according to H. Nilsson's method. The number of cases of cross-pollination in the two years in this case came to 16·7% and 37·64%. The cause of this large number of cross-pollinations is thought to be due to the pollen grains which were already clinging to the unopened flowers at the time of application of the parchment bags. To remove these and, at the same time, any insects which might be responsible for carrying the pollen, inflorescences were washed in tobacco water and the number of cross-pollinations was reduced to 5 (6·7%). As many as 94·5% cross-pollinations were obtained by isolating the two types together in Munerati's type of isolator, whilst with alternate isolators containing two sugar beets or two garden beets, only 0·47% of cross-pollinations occurred.
For genetical work, however, the only sure way seems to be the removal of the stamens and artificial transference of the pollen.

402. **Sengbusch, R.** **633.71:575**
Die Züchtung von nicotinfreiem und nicotinarmem Tabak. (The breeding of nicotine free tobacco and tobacco with low nicotine.)
Der Züchter, 1931, **3**, 33–38.
Experiments are described which shew that it is possible to breed tobacco with reduced nicotine content without losing the aroma. Large numbers of plants must be bred but the costs are not impossibly great.
The methods of work are described.

403. **Clausen, R. E.** **633.71:575.061.633:576.356**
Inheritance in *Nicotiana tabacum*. X. Carmine-coral variegation.
Cytologia, 1930, **1**, 358–68.
An individual was observed whose cytological and genetical behaviour indicated that it contained a fragment of a chromosome, which fragment contained the factor or factor complex for carmine as opposed to coral flower colour. By sporadic loss of this fragment variegation results.

404. **Kostoff, D.** **633.71:575.127.2:576.311.3**
Protoplasmic viscosity in plants. IV. Cytoplasmic viscosity in tumours of *Nicotiana* hybrids.
Protoplasma, 1930, **11**, 193–95.
Tumours, as a result of an increased cytoplasmic viscosity in the hybrids, favoured cell division.

405. **Webber, J. M.** **633.71:575.127.2:576.356**
Interspecific hybridization in *Nicotiana*. XI. The cytology of a sesquidiploid hybrid between *tabacum* and *sylvestris*.
Univ. Calif. Pub. Bot., 1930, **11**, 319–54.
A study is presented of a plant having $2n = 60$, which appears to have arisen from the union of a diploid *tabacum* (48) egg and a haploid *sylvestris* (12) pollen grain.
At metaphase I, there appeared trivalents, bivalents and univalents. The chromosome behaviour is described for the hybrid itself and for its hybrids with *tabacum* and *sylvestris*.
The hybrid itself resembled *tabacum* almost entirely, but when selfed or crossed with *sylvestris* intermediate characters sometimes appeared. This is supposed to result from the nearly homologous nature of the *sylvestris* chromosomes with certain of those of *tabacum*; thus in selfed progenies of the sesquidiploid and in its crosses with *sylvestris*, a complete pair of *tabacum* homologues may be replaced.
In the selfed progenies, many new chromosome combinations appeared and certain constant races possessing these combinations.

The loss of chromosomes from F2 to F6 in some cases had very little effect on the phenotype and in other cases a very marked effect ; this indicates that the F1 homologues were not completely similar.

In F6 24- and 25-bivalent plants were obtained whose cytological behaviour and fertility were similar to that of a pure species. The 24II plant resembled *tabacum*, the 25II had certain *sylvestris* features ; each might well rank as a new taxonomic race, and would be perpetuated if isolated from *tabacum* ; a similar origin of many existing varieties of *tabacum* and other species of *Nicotiana* is suggested.

406. **Goodspeed, T. H.** **633.71:575.243:537.531.4**
Inheritance in *Nicotiana Tabacum*. IX. Mutations following treatment with X-rays and radium.
Univ. Calif. Pub. Bot., 1930, **11**, 285–98.

Three stable lines resulting from X-ray treatment of *N. tabacum var. purpurea* are described. The X1 generation shewed great variety of flower colour and some plants displayed variations in habit, leaf shape and flower form. Certain of the pink variants were identical with types previously cultivated and studied and it seemed evident that mutation had occurred in a single gene.

In one X3 progeny a haploid plant occurred. A number of floral irregularities, including pistillody of the stamens, were also observed, another single, recessive gene mutation, albinism, also occurred, and a number of other changes, some of which involved more than one gene, and others chromosome aberrations.

407. **Kostoff, D.** **633.71:575.255:576.356.1**
A chromosomal chimera in tobacco. Somatic non-disjunction and doubling of chromosomes in a *Nicotiana* hybrid.
J. Hered., 1930, **21**, 445–48.

An unusual plant, which is described, appeared in the cross [*N. glauca* ($n = 12$) x *N. Langsdorfii* ($n = 9$)] x *N. Langsdorfii*. The plant was self-sterile, having abortive pollen and was also sterile with pollen of *N. Langsdorfii*.

In one root the cells of one half had 20 and of the other half 40 chromosomes. Later in the flowering season a new type of larger flowers with more abundant pollen and partially self-fertile appeared. Such flowers were found to have not 20 but 26 chromosomes at the homeotypic division. The chromosome doubling had resulted from somatic non-disjunctions.

408. **Webber, J. M.** **633.71:576.356.5**
Chromosome number and morphology in *Nicotiana*. V. The character of tetraploid areas in chromosomal chimeras of *N. sylvestris*, Speg and Comes.
Univ. Calif. Pub. Bot., 1930, **11**, 355–66.

A study is made of certain tetraploid cells occurring in the somatic cells. It is shewn that these cells, in the same way as haploid cells, multiply less rapidly than normal diploid cells. Pure tetraploid roots and shoots may, however, arise from such areas.

409. **Goodspeed, T. H.** **633.71:576.356.5:537.531**
Occurrence of triploid and tetraploid individuals in X-ray progenies of *Nicotiana tabacum*.
Univ. Calif. Pub. Bot., 1930, **11**, 299–308.

In the X1 progeny an abnormal plant of *Nicotiana tabacum var. purpurea* occurred, differing in many characters from the normal, having highly defective pollen, but capable of being fertilized by normal pollen. The F1 progeny of this plant contained abnormal and normal plants, one of the former proved to be triploid. It is suggested that the original abnormal plant was a trisomic which on fertilizing with normal pollen gave triploid, monosomic and trisomic types.

A weakling plant resulting from rather heavy dosage with X-rays of *Nicotiana tabacum var.* Maryland Mammoth, produced an extremely vigorous shoot from an adventitious bud. This shoot proved to be tetraploid. In certain plants, meiosis was abnormal, the entire 69 chromosomes becoming oriented on a giant spindle and subsequently dividing with the production of cells with still further increased chromosome number. This suggests that when polyploidy has once been induced, there is a tendency for it to increase.

410. **Kendall, J.** **633.71:581.163**
A parthenogenetic aberrant tobacco plant.
J. Hered., 1930, **21**, 363–66.
A description is given of a plant arising parthenogenically from pollination with pollen of *Petunia violacea* ($n = 7$) of a plant with aberrant chromosome number ($2n = 60$), itself having arisen from the selfing of a triploid plant. In metaphases of the second meiotic division, numbers of chromosomes varying from 26 to 30 were observed, representing two incomplete chromosome sets with a few extra chromosomes resulting from non-disjunction.
The plant was almost self-sterile, but gave 50% normal seeds when crossed with the normal, giving many new forms.

411. **Johnson, J.** **633.71–2.421.1–1.521.6:575**
Breeding tobacco for resistance to *Thielavia* root rot.
Tobacco, 1930, **90** (4).
The F1 hybrid of resistant x susceptible individuals was intermediate in reaction, the F2 shewing every degree of susceptibility and resistance. A number of individuals appeared in F3 in which resistance was dominant. The two chief resistant varieties and the hybrids are described.

412. **Wolf, J. G.** **633.71–2.421.1–1.521.6:575.242**
Black root rot resistant shade tobacco.
53rd Rep. Conn. Agric. Expt. Sta., 1929, Pub. Doc. No. 24, 256–63.
In 1927 a number of plants resistant to *Thielavia basicola* appeared for the first time in Cuban Shade tobacco. It seemed probable that they had originated by mutation, since in all other characters they were indistinguishable from the original culture and the progeny was particularly uniform.

413. **Lambers, H. R.** **633.73:575.42**
La sélection et le *Coffea robuste*. (Selection and *Coffea robusta*.)
Agric. élevage Congo belge, 1930, **4**, 180–81.

Robusta in Java used to represent a mixture of types, some of which resulted from hybridization of Uganda coffees, of " Kwillon " and of *C. canephora*. Selection is being vigorously practised.

414. **Wacker, J.** **633.78:575**
Zichorienzüchtung im Hohenheimer Versuchsfeld in den Jahren 1917–1929.
(Chicory breeding in the Hohenheim experimental plots in the years 1917–29.)
Z. Züchtung, 1930, **A. 15**, 419–30.
In crosses between the Belgian and wild forms, segregation occurred in F2 for leaf shape, there being many more of the round-leaved, cultivated type than the wild type ; also for root shape and branching. A number of different types were selected and compared in F5.
Different types were planted side by side, allowed to cross-pollinate and desirable types selected from the later generations.
Marked differences existed in the strains obtained in respect of yield, of roots, dry matter content and inulin content.

415. **Houard, H.** **633.855.34:575**

Oil palm selection at the Pobé Experiment Station (French West Africa).

Int. Rev. Agric. Mon. Bull. Agric. Sci. and Prac., Rome, 1930, **21**, 247–55.

The offspring of a first selection palm, *L*10, raised from seed in 1923, was examined and data are presented for trunk circumference, precocity, productivity, vegetative aspect of various plants. The offspring of the selected palm gave a mean annual yield of over 31 kg. of fruit over a four-year period. Palms differed in the speed with which they came up to full cropping and early observations were not always true indications of the final performance.

The number of bunches per palm of 4 years 10 months was 4·6 and for palms of 5 years 4 months 16 ; with increased age this number is expected to fall and the weight per bunch to rise.

The composition of the fruits will be examined later when the plants reach the age at which the composition is more or less constant. The results of a certain number of preliminary analyses of the first palms to be produced are discussed.

The general conclusions so far reached are that five palms have appreciably retained the qualities of the mother and six palms are definitely below this ; the importance of such selection is emphasized.

416. **Heusser, C.** **633.912:575**

Opbrengstcijfers van legitieme *Hevea* zaailingen in 1929 in den proeftuin Soengei Pantjoer. (Yield figures from legitimate *Hevea* seedlings in 1929 in the experimental garden Soengei Pantjoer.)

Arch. Rubberc. Ned.—Ind., 1930, **14**, 372–410.

The results are given of tests of seedlings from 1920 crosses, from isolated seed gardens and from 1923 crosses.

The 1920 seedlings were in the fourth year of tapping and differences in yield between the families were more pronounced than previously. The annual yield per tree for the best cross was 7·26 kg., compared with an average for all families of 4·66.

Many of the best individual trees from the fourth year did not give at all high yields in the first two tapping years. No method of early selection thus seems possible and large numbers of trees must continue to be tested.

A number of otherwise promising families had to be removed on account of brown bast, susceptibility to which is evidently also hereditary.

In general, the families which had previously shewn the greatest girth increases continued to do so.

Of 1922 seedlings (probably from self-pollination) one tree in the third tapping year greatly surpassed all others. Other groups of seedlings, some of which almost certainly arose from cross pollination with known adjacent trees, were variable, certain ones being considerably above the average.

The F_2 seedlings from 1923 pollinations are briefly described. Certain very good yielders occurred in one cross.

Some of the seedlings described in this paper approach or equal the yields of the best clones at present in use and still further improvement is expected.

417. **Kosemanoff, S. I., and Chomentovsky, U. I.**
634.1/2:581.162.5:581.331.23

(Materials for the determination of the interfertility of fruit trees under laboratory conditions.)

Bull. Mleev Hort. Expt. Sta., 1930, No. 39, 14 pp.

The behaviour of the pollen grains when germinated in sugar solutions alone and in the presence of styles of other varieties is described. In the case of apples the germination was neither increased nor retarded ; in some cases there was a positive tropism manifested in the pollen tube, in other cases negative ; a positive tropism was found to correspond to inter-fertility of the two varieties and vice versa.

418. **Paulino, P. L.** **634.58(91.4)**
Preliminary study of peanut varieties at the Lamao Experiment Station, Lamao, Bataan.
Philipp. J. Agric., 1930, **1**, 273–86.
Short descriptions of the varieties cultivated are given, followed by an account of yield tests of a number of dry and wet season varieties over the period 1923–28. Tennessee Red was the most productive in the rainy season, San Jose No. 3 in the dry season. This variety was also the highest yielder in pods and kernels. The yields in kernels, the shelling percentage, size of kernels, curing quality and oil content are also reported upon briefly.

419. **Stokes, W. E., and Hull, F. H.** **634.58:575**
Peanut breeding.
J. Amer. Soc. Agron., 1930, **22**, 1004–19.
The previous literature is reviewed, principally by Badami in the Annual Reports of the Agricultural Department of Mysore, in which the inheritance of eight characters is given. The species and varieties are then described and discussed, with the botanical characteristics of flower, fruit and seed.
Ten strains of Spanish were subjected to selection, with considerable increases in yield. There seemed to be no correlation between yield of nuts and of vines and roots. Twelve strains were intercrossed. The F_1 hybrids, in time of emergence, were intermediate between the parents; the F_2 shewed a great range in dormancy period, indicating that dormancy is a genetic character of the parents, being incompletely dominant to non-dormancy. There was very little increase in vigour in the hybrid plants over the parents.
Brick-red seed coat was dominant to tan, giving monohybrid ratios. The inheritance of certain more important economic characters is being examined.
Arachis hypogaea has been crossed x *A. nambyquarae*, but the reciprocal cross failed. The hybrids are fully fertile and are largely intermediate between the parental species, shewing no hybrid vigour. The red testa colour of *A. nambyquarae* was dominant and variegation in seed coat incompletely dominant. The flower production and special technique required for hybridization are described. Emasculation may be successfully performed when the calyx tubes have reached half their mature length, which usually occurs between 9 and 11 p.m.; hand pollination is effected the following morning.

420. **Smits, M. B.** **634.61**
Research work on coconut palms.
Int. Rev. Sci. Pract. Agric., 1930, **21**, 365–71.
The views and research of various authors on the origin, variation, biology of flowering of the various types and certain more general questions are dealt with.

421. **Heermann, W.** **634.73:575**
Die Züchtung einer Kulturheidelbeere. (Breeding a cultivated bilberry.)
Der Züchter, 1931, **3**, 38–44.
Hybrids between *Vaccinium Myrtillus* and *V. Prunus Idaeus* had a much smaller number of seeds than either of the parents. The seeds germinated well. The F_2 plants do not differ from ordinary bilberries, but in certain ones the clustered fruit formation of the latter is combined with the aroma of the former parent, which should considerably increase the yield. Varieties bred in the U.S.A. have also been introduced and proved very successful. Suitable methods of vegetative propagation of the plants are being sought, so as to multiply these varieties or use them for hybridization.

422. **Müller** **634.75:575**
Die Zucht der Ananaserdbeeren. (Breeding of strawberries.)
Traunstein, G.H. Stiefel, 1930.
A booklet explaining the principle of genetics as applied to practical strawberry breeding.

423. **Kihara, H.** 634.752:576.312.332
Karyologische Studien an Fragaria mit besonderer Berücksichtigung der Geschlechtschromosomen. (Caryological studies in *Fragaria* with particular reference to the sex chromosomes.)
Cytologia, 1930, **1**, 345–57.
The somatic chromosome number in *F. eliator* was 42, in *F. grandiflora* 56 and in the hybrid between them 49. The reduction division in *PMC* was normal, in *EMC* somewhat unusual in that one or two single chromosomes were frequently evident only slightly differing in size, and one pair of unequal chromosomes, the sex chromosomes, finally proving the heterozygous nature of the female in *F. eliator*.
The reduction division of the sterile hybrid was irregular.

424. **Walker, A.** 634.773
La Bananier Plantain au Gabon. (The plantain banana in Gabon.)
Rev. Bot. appl., 1931, No. 113, 18–27.
Notes on the varieties and their uses.

425. **Stummer, A., and Frimmel, F.** 634.835:575.061.633
Beiträge zur Genetik des Weinstockes. II. Vererbung der Panaschüre. (Contributions to the genetics of the vine. II. Inheritance of variegation.)
Z. Züchtung, 1930, A. **15**, 431–50.
The authors do not agree with the monofactorial explanation put forward by former writers. They find three factor pairs influencing chlorophyll development and variegation results from a vegetative segregation occurring in a heterozygous plant, with the formation of one cell with two factors and another with no factor for chlorophyll.
The factorial scheme gives a satisfactory explanation of the authors' results and also of many of the results of earlier authors.

426. **Kayser, E.** 634.835.094
Contribution à l'étude des vins d'hybrides. (Contribution to the study of the wines from hybrids.)
Rev. Vitic. Paris, 1930, **73**, 279–81.
The composition and the quality of wines from a number of hybrids was tested and the conclusion reached that it is possible to produce wines of high quality from hybrid grapes if modern methods of fermentation and selected ferments are used.

427. **Ravat, F. J.** 634.835.094
Les hybrides producteurs directs en 1929. (Hybrid direct producers in 1929.)
J. Agric. Prat. Paris, 1930, a **33**, 1, 132–34.
After a study of hybrid direct producers in France, the writer has come to the conclusion that M. Couderc's problem of the hybridization of the vine has been solved, because the hybrids will replace *vinifera* wherever the wine is required for current consumption.

428. **Durst, C. E.** 635.52:575.11
Inheritance in lettuce.
Bull. Illinois Agric. Expt. Sta., 1930, **356**, 239–341.
Lettuce is shewn to be largely self-fertilized, both in wild and cultivated species. Crosses were made between the more important cultivated varieties and between these and the wild *Lactuca scariola L.* The presence of *anthocyanin* was dominant to its absence, simple ratios occurring in

F_2 ; only in one cross was any appreciable deviation observed. Pigment in leaves and stems was always accompanied by coloration of the ray florets. No exception was observed, and it is thought that only one factor for pigmentation exists.
Monohybrid ratios were obtained also for the following dominant characters : black seeds ; presence of prickles on the underside of the midribs ; leaf margins and seed stalks. In some seasons there was a deviation from the normal ratio in certain prickly x smooth crosses in F_2, which is described as due to " disturbing influences." Linkage of the prickly factor with sterility factors sensitive to environment is a suggested explanation. Two complementary factors seemed to be present governing leaf form, lobed being dominant to unlobed.
The F_1 hybrids were intermediate with regard to leaf length in some cases, in others more nearly approaching the longer parent and in certain cases greater. Transgressive inheritance was evident in F_2 and in certain crosses the range of variation extended beyond the longer leaved parent. There were indications of partial dominance and multi-modal effects.
In F_3 and F_4 more or less homozygous families sometimes appeared with leaves considerably longer than the longer parent. Essentially similar results were obtained in the case of leaf-width, width index (width average/length average), leaf area, time of flowering, plant height at flowering, degree of heading.
It is shewn that the cultivated species contain factor combinations which exhibit a different type of response to weather conditions from that of the wild form ; the cultivated forms respond more favourably to moist conditions. The wild form is evidently more heterozygous as it exhibits a greater degree of variation. Mutations have apparently occurred.
Castle's method for calculating the number of genes involved in inheritance is regarded as not reliable by the author and certainly not applicable to the present case.
The origin of cultivated lettuce can be accounted for by loss of additive factors and mutation in the wild form *L. scariola* L. The Cos is the only cultivated type which possesses genes dominant to the wild form. This may have arisen from another wild ancestor, or the dominant genes may have arisen by mutation or have been introduced from other compositae.
The results support the system of nomenclature proposed by Barley.

429. **Whitaker, T. W.** **635.6:576.312.35**
Chromosome numbers in the *Cucurbitaceae*.
Anat. Rec., 1930, **47**, p. 379.
The results of chromosome counts of four species are presented, viz., *Luffa acutagula*, *Ecballium elaterium*, *Momordica balsamia* and *Momoridica charantia*. A cytological study of several peculiar forms of cultivated species has failed to reveal any abnormal chromosome numbers.

430. **Jagger, I. C., and Scott, G. W.** **635.61–2.421–1.521.6:575**
Melons resistant to powdery mildew.
Phytopathology (Abs.), 1931, 21, 113–14.
Amongst a mixed lot of seeds from India numerous plants of *Cucumis melo* almost immune from *Erysiphe cichoracearum* were found. These were crossed with commercial varieties of cantaloupes and muskmelons, followed by backcrossing and selection. Mendelian segregation occurs for resistance, which is partially dominant.
Resistant melons with all the desirable commercial characteristics will soon be established.

431. **Layton, D. V., and Wilson, J. J.** **635.615–2.484–1.521.6**
Three new wilt-resistant varieties of watermelons.
Phytopathology (Abst.), 1931, **21**, p. 114.
Three varieties have proved highly resistant to *Fusarium niveum* and compare extremely favourably with commercial types. One is also resistant to anthracnose.

432. **Sinnott, E. W., and Hammond, D.** **635.62:575.113:581.47**
Factorial balance in the determination of fruit shape in *Cucurbita.*
Amer. Nat., 1930, **64**, 509–24.

Two independent factors, *A* and *B*, are to have a flattening effect on the fruit of *C. pepo* and inbred lines of the constitution *AAbb* and *aaBB* were crossed. The F1 was flattened and a 9 : 3 : 3 : 1 ratio occurred in F2, the double recessive being elongate. Other elongate fruits, however, obtained commercially, behave in quite a different way on crossing with disks and spheres. An examination of the genetic behaviour of such plants led to the conclusion that a third factor *C* was present, cumulative with *A* and *B*, together with a factor which acts as an inhibitor to these flattening factors. Results indicate that this factor in the heterozygous condition can inhibit one flattening factor and in the homozygous condition it can inhibit two. Other lines seem to contain another distinct inhibitor.
Such a hypothesis is supported by a series of F2, F3 and back-cross results.
These shape factors act and are inherited quite independently of the factors governing the actual size of the fruits.

433. **Castetter, E. F.** **635.62:575.127.2**
Species crosses in the genus *Cucurbita.*
Amer. J. Bot., 1930, **17**, pp. 41–57.

The origin of the cultivated species is briefly discussed, followed by a description of the three American species.
The chromosome numbers of x = 20 found for *C. maxima* and *C. Pepo* and x = 24 for *C. Moschata* are at variance with results of certain other workers.
Species crosses in the past have produced very few seeds and the offspring have been said to display a marked tendency to parthenogenesis.
A number of hybrid plants was obtained from various crosses between the three American species and are described. In some cases the F1 was sterile whilst in other cases the F2 and F3 were grown and found to be fertile.
Hybrid vigour was evident in some of the hybrid plants.
The cross *C. maxima* x *C. Moschata* proved the easiest cross but the F1 was self-sterile. *C. Pepo* x *C. Moschata* was successful but not the reciprocal. The most difficult cross was *C. maxima* x *C. Pepo.*
No evidence of parthenogenesis was found but many of the pollinations resulted in parthenocarpy.

434. **Sinnott, E. W.** **635.621:575 –181:581.47**
The relation of size to shape in the heredity and development of *Cucurbita* fruits.
Anat. Rec., 1930, **47**, p. 387.

It is shewn that size factors and shape factors in *Cucurbita pepo* are inherited independently, although in certain cases the size of fruit at maturity affected the development and thus the ultimate shape of the fruit.

435. **Myers, C. E., and Lewis, M. T.** **635.64:575.42**
The effect of selection in the tomato.
Bull. Penn. Agric. Expt. Sta., 1930, **248**, pp. 20.

Experiments are described which make it clear that further selection after a pure line has been established is of no avail.

436. **Huelsen, W. A., and Gillis, M. C.** **635.64–2.484–1.521.6:575**
Breeding two new varieties of greenhouse tomatoes resistant to *Fusarium* wilt.
Bull. Illinois Agric. Expt. Sta., 1930, **361**, 409–34.

Various crosses were made between certain resistant varieties and Grand Rapids Forcing, a partially resistant and very productive variety which fertilizes well in the greenhouse.
Seeds were saved from those F 1 plants which were resistant and two F 2 plants were selected from each family. This was repeated in F_3 and F_4, and the F_5 was tested more fully. In F_7 crosses were made between the most promising lines.
Lloyd Forcing came from a cross of Louisiana Pink x Grand Rapids Forcing. It is fully resistant, having oblate, solid red fruits, blossoming freely and with a rapid, vigorous growth. It is not very susceptible to blossom end rot. It is taller and more vigorous than either parent.
Blair Forcing is a pink variety from the same cross, otherwise very similar to Lloyd Forcing, except in wilt resistance, Blair Forcing being distinctly superior, both to Lloyd Forcing and the more resistant parent. The two new hybrids have also the advantage of being earlier.

437. **Kakizaki, Y.** **635.646:575.125**
Breeding " crossed eggplants " in Japan.
J. Hered., 1930, **21**, pp. 253–58.

The F 1 seed gave immediate increase in weight over that of the selfed seed of the mother plants. The increased weight results from an increased size of the embryo. Marked increases in yield were also noted, these increases varying with the degree of diversity of the two parents.
Comments are also made on the inheritance of branching, leaf and fruit characters in F 1, on the choice of characters for parent varieties used in crossing on a commercial basis and on the technique of crossing.

438. **Kakizaki, Y.** **635.646:575.125**
Hybrid vigor in egg-plants and its practical utilization.
Genetics, 1931, **16**, 1–25.

The F 1 seed of most crossings shewed an immediate increase in weight over the selfed seed of the female parent, in no case was it below. This increase in weight is due to an increase in size of the embryo. The stem diameters of the hybrids were in eight crosses less, in one cross the same and in 19 crosses thicker than the median diameter of the parents, averaging an increase of + 5·8%. These variations are ascribed to varying degrees of heterozygosity with respect to a certain number of dominant factors for thickness. Similar results were obtained for height of plant ; there was an appreciable correlation between these two characters.
Hybrids were on the average 3·1 days earlier than the median time of ripening for both parents and many were earlier than the early parent.
The yield of the hybrids averaged 36·1% more than the average of the parents and 17% more than that of the higher-yielding parent. Most of the crosses where the greatest increases in yield were exhibited were those between widely divergent types.
There was a high correlation between the yield of the parents and that of the hybrids, but no significant correlation between the yield of the parents and the increase of yield on crossing. There was also a significant correlation between the increase in yield and of earliness, a point of considerable practical importance.
The hybrids were intermediate for the habit of branching, size of leaflet, shape of fruit ; black fruits were dominant to white and a lower number of spines on the calyx dominant to a greater number.
The two crosses most suitable for commercial use gave yield increases of 75·7 and 50·8% respectively over the most commonly cultivated variety. As the plants yield very large quantities of seed, the use of hybrid seed is a practicable commercial proposition.
The technique of hybridization is described.

439. **Miyake, K., Imai, Y., and Tabuchi, K.** **635.652:575.11.061.6**
Contribution to the genetics of *Phaseolus vulgaris.*
J. Coll. Agric. Imp. Univ. Tokyo, 1930, **11**, pp. 1–20.
A study of the F 1 and F 2 of various crosses shewed that red stem is dominant and allelomorphic to pink, but when crossed with green either monohybrid ratios might be obtained or dihybrid giving red, pink and green.
Certain crosses involving two greens produced coloured offspring. These results are interpreted on the basis of two genes for green stems, the dominant allelomorphs of both of which are necessary to produce colour ; colour itself is dependent on a further pair of genes red-pink.
The colour of flowers borne on these coloured stems was the same as that of the stem, red or pink ; green stems, however, might produce red, pink flecked or white flowers. White flowers might carry red or pink genes. Flecked behaved as a simple recessive to coloured flowers. The behaviour of a number of different combinations of these genes in various crosses is given.
Various different seed coat patterns are described, produced by the action of three modifiers on the gene for piebald, which is recessive to self-colour ; and by two dominant complementary genes for mottling, both of which are closely linked with one of the two recessive genes for cream. White behaves as a simple recessive to coloured.
A large series of seed coat colours exists, all grades being hypostatic to black.

440. **Zweede, A. K.** **635.652:575.22**
Beoordeeling van de variatie in vroegrijpheid en productie en daarmede gepaard gaande selectie van de " Vroege Wagenaar Boon." (Detection of variation in earliness and productivity and selection of the " Early Wagenaar bean.")
Med. v. d. Landbouwhoogesch. te Wageningen, 1930, **34** (3), 30 pp.
A race of beans (*Phaseolus*) was selected over a number of years for earliness and yield. Different races were selected and compared. The wide differences which were thus brought about indicated the necessity for continuous selection even in self-fertilized crops in order to retain the purity.

441. **Woycicki, St.** **635.652:575.242**
Mutationen der Hülsen und der Körner bei *Phaseolus vulgaris.* (Mutations of the pods and seeds in *Phaseolus vulgaris.*)
Acta Soc. Bot. Pol., 1930, **7**.
A mutation which occurred in a constant line and proved to be due to a single factor is described.

442. **Müller, L.** **635.655:575(43)**
Ueber Sojabohnenzüchtung. (Soya bean breeding.)
Der Züchter, 1930, **2**, pp. 277–88.
There are many places where soya beans are in cultivation in a climate similar to that in Germany. A large collection of material was obtained from all parts of the world and subjected to selection for such characters as earliness, yield, habit, protein and fat content, disease resistance. The varieties differed very much in size and weight of seed, as also in the seed-coat colour.
Selecting for oil content, a rise in oil content was often accompanied by a fall in protein, but the relative proportions of these differed for different varieties.
Almost all varieties with brown or black seed were free from starch. Mottling of the seed-coat is dependent both on genetic and environmental factors.
The flowers are small and difficult to cross. Flowers may be white or lilac, the difference being determined by a single gene. The earliest varieties mature in about 75 days. Earliness is one of the characters on which most selection work has been done. A number of varieties were tested in small plots ; very clear differences were noted in yield, habit and other characters.

443. **Stewart, R. T., and Wentz, J. B.** **635.655:575.11.061.63:581.48**
A defective seed-coat character in soybeans.
J. Amer. Soc. Agron., 1930, **22**, pp. 658–62.
The character is expressed only in the defective-black and buff and not in the yellow seeds; moreover, all plants with defective seeds had "gray pubescence." It is therefore assumed that *De* for normal seeds is completely linked with *T* for "tawny pubescence." The ratios of the respective classes in F_2 and F_3 support this assumption.

444. **Veatch, C., and Woodworth, C. M.** **635.655:575.182.061.6**
Genetic relations of cotyledon color types of soybeans.
J. Amer. Soc. Agron., 1930, **22**, pp. 700–2.
Certain strains with green cotyledons when used as ♀ parent, always produced green seeded progeny. These strains used as ♂ parent crossed with ♀ with yellow cotyledons gave a yellow F_1 and in some cases in F_2 yellow to green, 15 : 1, in others all yellow, showing that the maternal green cotyledon type carries genetic factors for yellow. The theoretically possible maternal green with genetic factors for green has not been isolated.

445. **Wellensiek, S. J.** **635.656:575.116.1**
Linkage studies in *Pisum III*.
Genetica, 1930, **12**, pp. 1–32.
The linkage relations of 14 genes were studied. Crossing over percentages and interference relations were calculated. Crossing over was consistently higher in some crosses than in others, from which it is argued that "the genotypes of the parents of the cross determine the rate of crossing over in general." The number of independent groups or single genes is nine, exceeding by two the chromosome number seven. There were five independent single genes, in addition to four linkage groups, so that the possibility still remains that some of these genes are linked with 50% crossing over.

446. **Hammarlund, C., and Håkansson, A.** **635.656:575.116.1:576.356**
Parallelism of chromosome ring formation, sterility and linkage in *Pisum*.
Hereditas, 1930, **14**, pp. 97–98.
Only in those cultures which have the ring are the characters linked; partial sterility of the pollen grains also only appears in the ring plants.

447. **Lutkov, A. N.** **635.656:575.127.2**
Interspecific hybrids of *Pisum humilis* Boiss x *Pisum sativum* L.
Proc. U.S.S.R. Congr. Genet. Plant- and Animal-Breed., 1930, **2**, 353–67.
Various irregularities of behaviour in F_2 and F_3 shew that *P. humile* is a distinct species.

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